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A twenty-ton dinkey engine carried across the canyon at Elephant Butte, New Mexico, where a dam is being built across the Rio Grande River.

TRANSPORTING A LOCOMOTIVE ON A CABLEWAY.—[See page 470.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Shall We Retard, Divert, or Confine Our Flood Waters?

EVER since our issue of May 3rd, in which we devoted considerable space to the control of the Mississippi River, the Editor of the SCIENTIFIC AMERICAN has been receiving quantities of letters on this most important subject, which was to be expected when we reflect that the drainage area of the Mississippi system involves about two fifths of the country. However, while many of the letters have been highly appreciative, others have called us to account for championing the levee system and for not favoring this or that bill introduced before Congress. The Editor has a collection of these bills before him. About a dozen have been introduced before the present session, most of them, however, being of little importance for the reason that they call for local appropriations.

But the particular bill which has figured conspicuously in most of the letters is one that was introduced by Senator Newlands before the last session of Congress. This provides for the creation of a Board of River Regulation, an appropriation of fifty million dollars annually for ten years to be used in overcoming the floods of the Mississippi and the Sacramento and San Joaquin rivers, and for co-operation between the Government bureaus and States, municipalities and local agencies.

We have no fault to find with the broad purpose of this bill. There isn't a shadow of doubt that the control of the Mississippi River with its great tributaries is a national problem. A large majority of the States of the Union contribute in whole or in part to the enormous floods that pour down through the Mississippi Valley. We thoroughly believe in co-operation between State and Federal authorities in the control of these floods, and heartily endorse that section of the bill which aims to secure financial co-operation of States to an extent at least equal in amount to the sum expended by the Federal Government. Only by co-operation can such an enormously large water course be regulated.

Nevertheless, the SCIENTIFIC AMERICAN must take exception to certain provisions in the bill, which, although made in good faith, clearly indicate that the framer of the bill had no adequate conception of the vastness of the subject he was dealing with.

Col. Townsend's paper, published in the SCIENTIFIC AMERICAN SUPPLEMENT of May 3rd, discussed this matter at length. He showed that in order to hold back five hundred thousand cubic feet of water per second it would be necessary to reforest a territory equal to one sixth of the area of the United States. Furthermore, it would take a hundred years for such a forest to grow and shed enough leaves to form the spongy humus necessary to retain this amount of moisture.

The reservoir idea put forth in the bill is also based on a popular misconception of the vast amount of water that flows down the Mississippi system. It is usually contended that the reservoirs could be made to pay for themselves, owing to the amount of hydro-electric power that could be generated by the use of their waters. But in order to obtain a working head, such reservoirs would have to be placed near the headwaters of the rivers and tributaries, where they would be of little service in taking care of the floods on the lower reaches. It has been demonstrated conclusively that a reservoir will only regulate the flow of the river in its immediate vicinity, but will have very little effect on points a hundred miles or so farther down stream. Col. Townsend has shown that if a reservoir were placed near Cairo, Ill., it would have to cover something like seven thousand square miles and would have to be excavated to a depth of fifteen feet in order to take care of the water that rises above the normal banks of the river. This would involve an excavation nearly five hundred times as great as that of the Panama Canal.

The SCIENTIFIC AMERICAN believes in reforestation. Our woodlands ought to be extended. The timber is badly needed. We favor the construction of artificial reservoirs wherever possible. With the increasing demands on our steadily diminishing coal supply, we shall have to turn to hydro-electric development. We favor swamp reclamation and the building of drainage and irrigation systems where needed. But what has all this to do with the control of the Mississippi? We cannot encourage the false hope that any of these schemes, taken singly or collectively, will have any material effect on the enormous torrents of water which pour down the Mississippi Valley.

A bill was introduced before the House of Representatives a few weeks ago, which purports to provide an entirely new solution of the Mississippi problem. It calls for the purchase by the Government of a strip of territory ten miles wide running parallel to the Mississippi to the west, this strip to be extended eventually from the Gulf to Cairo, Ill. Along each edge of this ten-mile strip a levee is to be built, and into the channel thus formed, the flood waters of the Mississippi are to be diverted, providing them with a new outlet to the Gulf. The idea is far from new. Thirty years ago the outlet system of the control of the Mississippi was widely discussed and condemned, largely because of the fear that the Mississippi might take the notion to change its course completely and leaving the cities along its banks high and dry. It was proposed at that time to connect the Mississippi with the Atchafalaya River and allow this to take off the surplus waters. The fear of such a sudden diversion of the main channel on the Mississippi led to the construction of ground sills in the Atchafalaya at various intervals. These consisted of large willow mats weighted with stones and sunk to the bottom, the idea being that they would retard any scouring that might result from the increased volume of water pouring down the Atchafalaya. This done, it was considered safe to let the overflow of the Mississippi run into the Atchafalaya, which it does at the present time. The ground sills are still in place and they have successfully prevented the Atchafalaya from being scoured out to such a depth as to change the course of the Mississippi.

It is the purpose of the present bill before Congress to provide an Atchafalaya ten miles wide, so that the Mississippi River could never rise to anything like its present flood levels, but the promoters of this bill do not seem to realize that a channel such as this would fill with sediment, if the current were not swift enough to carry the material on down to the Gulf, and if it were made swift enough, might not the river take the bit in its teeth and run down the new channel instead of the old? The Mississippi problem would not be half so difficult if it did not carry so large a percentage of sand. But why discuss this proposition? Would not the cost of purchasing a ten-mile strip along the Atchafalaya be practically prohibitive? Would it not call for the building and maintenance of double the present levee system? And then what advantages would it have over the present system, in which large areas are occasionally flooded? Why not condemn the present flooded areas and be done with it? However, hasn't the levee system already vindicated itself? This year there have been only two serious breaks, one at Meyersville, Miss., and the other near Lake St. John, Louisiana. But the rest of the hundreds of miles of levees stood up well. Apparently to control the lower Mississippi it is merely necessary to make our levees higher and stronger. The fear that the bed of the river is being raised by the levees is groundless. It has been conclusively proven, not only in the investigation of the Mississippi River, but in that of many rivers abroad, that levees do not tend to raise the bed of the river to any appreciable extent. The Mississippi River bed is estimated to be one tenth of a foot higher this year than it was a hundred years ago. The present high-water readings merely indicate that the levees are doing their work better by confining the river to its course, and we must continue to build them stronger and higher until they are capable of taking care of the maximum flood. Any other form of control is hopelessly inadequate.

Personal Error and Efficiency Engineering

IT is the part of the scientific man to discover the truths of nature. But as there is nothing absolute, all his observations are necessarily more or less vitiated by errors. It is not enough for him to reduce these errors to a minimum. He must assure himself that he knows their nature, the order of their magnitude, and their influence upon the conclusions and operations which he bases upon his observations. All these points have received due attention, and a fairly complete "theory of errors" thus developed forms part of the stock-in-trade of every worker in the exact sciences.

But scientific observation and manipulation is merely a refinement of common every-day practice, and errors of observation and of operation play an important rôle in our daily pursuits also. How much a man's earning capacity and even life depends upon the perfect working of his senses and limbs is often not realized by him until age, illness or accident has impaired it. Not only is there such a qualitative relation between a man's physical and mental well-being and his earning power, but accident and life insurance companies, as well as courts in deciding actions for personal injury, find themselves confronted with the problem of establishing some quantitative estimate, however crude, of the value of a man's organs, their influence upon his earning capacity or "efficiency."

It would be a poor policy that should take note only of the value of lost faculties. To the efficiency engineer more than to any other person we owe it that our attention has been drawn to what might be termed "false motions," i. e., errors of operations, and their influence upon the efficiency of the industrial worker under normal conditions. And not merely qualitative, but quantitative studies, made with watch and camera, have furnished us a truly scientific groundwork on which to base improved manufacturing methods, to secure greatly increased efficiency. It is sometimes falsely supposed that the additional output thus harvested is the result of increased pressure placed upon the worker. If instances of this kind have occurred, they are contrary to the purpose which the originators of the movement for increased efficiency had in view: the output is to be increased, not by increasing the pressure of work, but by decreasing the resistance, by eliminating waste in lost motion and misplaced energy. Such increase in the output *must* result on the whole in a gain to the entire community; perhaps not always in a gain evenly distributed among all members of a community, but nevertheless, in a gain to all.

The International Magnetic Survey

SEVERAL features of the remarkable work carried on by the Department of Terrestrial Magnetism of the Carnegie Institution—as, for example, the construction and the cruises of the non-magnetic yacht "Carnegie"—have attracted general attention, and have been extensively written up in the popular as well as the scientific press. On the other hand, persons who actually have occasion to use magnetic data, for either scientific or practical purposes, have been wondering how soon the institution in question would put the results of its vast undertaking into statistical or cartographical form for the benefit of the world.

There has now been published the first volume of a series under the general title "Researches of the Department of Terrestrial Magnetism," in which all the results of the department's work will be collected as fast as possible. The initial volume is entitled "Land Magnetic Observations, 1905-1910," and is Carnegie Institution Publication No. 175. Future volumes will contain the results of the work on land subsequent to 1910; of the cruises of the "Galilee," 1905-08; and the work done on the "Carnegie" from 1910 onward. While these publications will deal chiefly with terrestrial magnetism, they will also contain occasional memoirs on atmospheric electricity and other subsidiary subjects.

The Department of Research in Terrestrial Magnetism—to give it its full title—was founded April 1st, 1904, its principal object being to secure data for a general magnetic survey of the globe. Under this general head its work is twofold, comprising the correlation and consolidation of the national and local magnetic surveys already under way in various parts of the world, and the execution by the department itself of magnetic surveys where none have been undertaken. The latter part of the programme involves a good deal of downright exploration in little-known lands and over untraveled seas. The volume now before us, which deals entirely with observations made on land, is illustrated with photographs, abounding in local color, showing field stations all the way "from China to Peru." It should be explained that such photographs are not merely ornamental, but serve the practical purpose of identifying the exact location of the stations, so that they may be reoccupied at any future time for the purpose of making comparative observations. No less interesting than these photographs are the narratives of the journeys made by the various observers, often bristling with adventure. Of course, the substantial part of the volume is the tabulation of the observations.

A full account is given of the instrumental equipment and methods of reduction. It is explained that the publication of the results contained in the present and subsequent volumes has been delayed by the many problems presented when magnetic observations made over the greater part of the globe are to be published on a uniform basis.

Electricity

The Electrical Export Figures for March have just been published by the Bureau of Foreign and Domestic Commerce. They show a remarkable increase over the figures for March, 1912. The total for the month this year was $2,489,374, whereas for the corresponding month last year the total shipments amount to $1,833,680. The total for nine months ending with March is $19,348,066 as against $14,573,898 last year.

Charging Stations for Electric Vehicles.—The New York Electric Vehicle Association has just issued a handbook for the users of electric automobiles. It contains a list of charging stations in the city of New York, on Long Island, up the State as far as Hudson, east as far as New Haven, west as far as Easton and south to Philadelphia and Atlantic City. The handbook also contains a chapter on the care of both lead and nickel-iron batteries.

The Largest Turbo-generator in the World is being built for the Commonwealth Edison Company of Chicago, by the General Electric Company. It is of the horizontal turbine type and will generate 30,000 kilowatts. The over-all length of the machine will be 60.5 feet and it will be 18 feet 4 inches wide by 14 feet high. It will run at 1,500 revolutions per minute. The generator will be a 25-cycle, 3-phase machine with two poles, and the output will be 1,925 amperes per phase with a voltage of 9,000. The total weight of the turbine and generator combined will be about a million pounds.

Wireless in Canada.—At Le Pas, Manitoba, the southern terminus of the Hudson Bay railway, there will soon be erected the second largest wireless station in Canada. It will include four 250-foot steel towers and will cost about $100,000. Plans are under discussion for establishing several wireless stations in the far Northwest; viz., from Athabasca Landing up the Mackenzie River to Herschel Island, in the Arctic Ocean, and from there to Rampart House, in the Yukon. Such stations would be valuable for scientific purposes, especially for collecting meteorological reports, and would also be serviceable to the Northwest mounted police.

Non-absorbent Slot Insulation in Motors.—A motor used in tropical climates is apt to develop defects which do not appear under other conditions, for the reason that it is subjected to high temperatures and a great deal of moisture. It has been found that the absorbent insulation used in the slots in stators is responsible for a good deal of trouble. Where this weakness has developed the motors have been rewound with micanite insulation and this has cured the trouble. A similar condition of affairs might result even in temperate zones, where the motor is situated in a damp place subject to high temperatures. In such position it is advisable to use a non-absorbent slot insulation.

Indirect Street Lighting.—We have been taught to appreciate the advantages of indirect, direct-indirect and semi-direct lighting over the dazzling illumination and injurious glare of naked lamps. But so far these improvements have been applied only to interior lighting. Our streets are still lighted by direct illumination. Could not indirect lighting be employed here too? It certainly would be preferable to have a street lighted throughout its length by a soft evenly distributed light in place of the present system of bright spots with jet-black spaces intervening. At a recent meeting of the Illuminating Engineering Society of Great Britain, J. Darch suggested that streets could be illuminated in this way by casting the light against housefronts from which it would be reflected to the street again. In this way the glare of the lamp would be overcome. Objections to such a system immediately present themselves. It would be difficult to place the lamps in such a way that the glare would not be objectionable to the occupants of the building while using at the same time a reflecting area sufficiently large to provide efficient illumination.

Platinum Terminals for Quartz-tube Mercury-arc Lamps.—In order to obtain higher efficiency and better light values from mercury arc lamps, it has been the practice to substitute quartz tubes for glass, and to operate the lamps at higher voltages and consequently higher temperatures. One of the principal difficulties encountered has been that of sealing in the terminals of the lamps. The co-efficient of expansion of quartz is 0.5×10^{-6} and that of platinum is 9×10^{-6}. This great difference of expansion has made it necessary to employ some other metal. Now tungsten with a co-efficient expansion of 3.5×10^{-6} is being used. The difference of the co-efficient expansion is such that the tungsten can not be sealed directly in the quartz, but instead is sealed in a boro-silicate glass of the same co-efficient of expansion and of a high melting point, while between this seal and the quartz tubes a number of glasses of varying co-efficient of expansion are used, providing what is known as a "graded seal." It has been suggested that this method of introducing electrodes into a bulb could also be used in connection with ordinary incandescent lamps. If so, it would materially reduce the heavy demands of the electrical industries on the expensive and precious metal platinum.

Science

The Willard Gibbs Medal Presented to Dr. L. H. Baekeland.—On Friday, May 16th, the Willard Gibbs medal was presented to Dr. L. H. Baekeland by the Chicago Section of the American Chemical Society.

A Magicians' Club has been founded in London and has just opened its clubhouse. The membership comprises more than 200 professional and amateur conjurers. The clubhouse will include a museum of magic, a library of some 500 technical works on conjuring, and an experimental room with appliances for making new tricks.

The Time Service of the U. S. Naval Observatory has become much more generally useful than heretofore through its transmission by radio-telegraphy, especially since the opening of the great wireless station at Arlington. The noon signal has been transmitted by radio-telegraphy to ships at sea since January, 1905, and it is believed that this observatory was the first by over two years to have its time regularly transmitted in this way. The utility of the service on land is illustrated by the fact that thousands of jewelers are receiving or arranging to receive their time from the radio signals.

The New Ministry of Agriculture and Forestry under the Chinese Republic will be extensively officered by young Chinamen who received their technical education in the United States. Lai Kuei Liang, a 1908 graduate of the Massachusetts Agricultural College, has been appointed vice minister of agriculture and has begun the issue of the Chinese Agriculture Journal. E. L. Hsieh, a 1909 graduate of the same institution, has charge of the translation of foreign agricultural literature into Chinese for this ministry; while H. Jen, a classmate of Mr. Hsieh, is director of the agricultural experiment station at Mukden, Manchuria.

Cellulose from Asparagus.—The American consul at Hamburg has reported the details of the process invented by Prof. Otto Reinke for the recovery of cellulose from asparagus waste (from canning factories) and from the asparagus stalks that mature after the edible crop has been gathered. Heretofore these residues have been practically worthless except as fertilizers, as they have but little nutritive value when used as fodder, and attempts to utilize them in making coarse paper or packing material have not resulted satisfactorily. After undergoing a comparatively simple mechanical and chemical treatment they yield a beautiful pure cellulose, which may be used for bandages, blasting material, paper, tissues, fine felt, cardboard, etc.

A Franco-British Scientific Congress.—Special interest attaches to next year's meeting of the Association Française pour l'Avancement des Sciences, which is to be held at Havre, probably September 4th to 12th. A large number of British societies are to take part in the meeting. There are 160 British societies affiliated with the British Association for the Advancement of Science, and it has been the custom for these societies to hold a conference in London whenever the association itself met in some far distant city—as in the case of the meetings at Winnipeg and in South Africa. (Strange to say the British Association has never met in London.) Now it happens that in 1914 the British Association meets in Australia, and comparatively few members will be able to make the long and expensive journey, aside from those whose expenses are to be paid out of funds raised for this purpose in Australia. Accordingly, as Havre is comparatively near England, it has been decided to hold the conference of delegates from the affiliated societies at that place, in conjunction with the meeting of the French Association. It is hoped that American scientific societies will also be represented at this joint meeting.

The Greatest Wind Velocities are undoubtedly those occurring in tornadoes. The recent destructive storms of this class raise the question: How high was the wind? but this question cannot be answered satisfactorily. In the Annual Report of the Chief Signal Officer for 1875, p. 435-436, there are some attempts to estimate the velocity of the wind in a tornado of that year from its more remarkable effects; e. g., a pine board driven through a telegraph pole; another driven three inches into the trunk of a tree, and so on. A velocity of wind sufficient to produce such results could not have been much less than that of a cannon-ball, or somewhere between six and eight hundred miles an hour. It is doubtful whether we shall ever have instruments for measuring such winds, but on the other hand something might be done toward providing stronger instruments than those now in use, so that in winds of ordinary hurricane velocity the anemometer would not be carried away just when about to make its most interesting record. The need of such an instrument is pointed out by Maxwell Hall, government meteorologist of Jamaica, in an account of the hurricanes of last November in that island. A Robinson anemometer exposed to the hurricane of November 18th broke away when registering 120 miles an hour. Probably the highest velocity ever recorded by an anemometer was 186 miles an hour, on Mt. Washington, January 11th, 1878; but this and all other high records of anemometers (i. e., of the Robinson type) are well known to be greatly in excess of the true velocities.

Automobile

A Solid Pneumatically Cushioned Tire.—In a patent, No. 1,059,115, Philip H. Calmus of Birmingham, Ala., presents a vehicle tire having an outer solid rubber tire with recesses upon its inner side and an inflatable inner tube with integral air cushions which fit into the recesses in the solid rubber tire so that the solid tire protects the inner tube and the latter is held from motion relatively to the solid tire.

Testing Carbureters.—The Benz firm, the well-known automobile and internal combustion engine constructors of Mannheim, recently donated the sum of $12,500 with a view of starting a fund for installing a special laboratory for experiments upon carbureters for gasoline motors. The laboratory is to be installed at the Hochschule of Karlsruhe. In addition to this, it is stated that different subsidies have been collected for the purpose of founding a mechanical testing laboratory and shops at the same institution.

Tire Makers Adverse to Tire Fillers.—Whether or not there is any particular virtue in the various substitutes for air that have been developed and urged upon the public, the tire makers themselves do not take kindly to them at all. As a matter of fact, they strongly advise against their use and have stated that guarantees will be rescinded if any other medium than air is used in their casings. They give as their reason for the odium that has fallen on the tire fillers, the heat they generate and harbor and the deteriorating effect it has on the rubber.

How Will Automobiles Be Improved?—It is difficult at this time, when automobiles have reached such a high degree of excellence, to indicate wherein improvements will be made. In talking, however, with the writer, the owner of a medium-grade machine complains of the paint peeling off the metal body of his machine and expresses the belief that improvements will be made either in the paint itself or in the method of its application which will increase the durability of the painted surfaces upon the metal body of the machine. At any rate, the field is a large one for inventors along this particular line.

Kerosene Without Gasoline Priming.—Despite the advances that have been made in the employment of kerosene for engines nominally constructed to burn gasoline, either preliminary heating or the use of gasoline is necessary for starting. In order to afford a stimulus to inventors to overcome this difficulty, the Chambre Syndicale de l'Industrie du Petrole, of Paris, has decided to offer two prizes in connection with a proposed competition to discover the best means, if any means exist, to use kerosene without the necessity for using gasoline for starting purposes. The prizes are $1,000 and $500, respectively.

Storing Gasoline in Scotland.—A Glasgow newspaper explains a method of keeping petrol or gasoline to avoid waste by evaporation which was being projected in Glasgow by a London concern. The fluid is stored in a tank and the storage tank is always full of liquid, no air being admitted at any time. The tank may be filled with all gasoline or part gasoline and part water, water being pumped into the tank to force off the gasoline when it is desired. The water is drained off when it is desired to replenish the gasoline in the tank. Means are provided for preventing water from passing off with the gasoline, and it is claimed that there is no loss from evaporation, no gas is forced out in refilling the tank and the gasoline will not deteriorate no matter how long it is kept in the tank.

City Gas for Engine Testing.—By way of reducing overhead expense, one of the largest of the Detroit automobile manufacturers has adopted the novel expedient of testing his engines on city gas. Preliminary to being placed in the chassis, all engines are "run in" under their own power for periods upward of an hour and the expense for gasoline is no small item. Under the new *régime*, however, it is estimated that sufficient city gas to run one engine as long as it would run on two gallons of gasoline at 17 cents a gallon, which is the wholesale price, costs in the neighborhood of 8 cents. Inasmuch as the manufacturer in question will build at least 150,000 engines during the year, it may be appreciated that the saving for fuel will be considerable. The same method has been adopted abroad in some of the large Coventry factories with gratifying results.

Accelerators and Instinctive Bracing.—It is a psychological fact that the imminence of collision causes the driver of a motor car instinctively to brace himself against the impending shock, which brings to light that if he has his feet where they logically should rest, one on the clutch pedal and the other on the brake pedal, the greater the bracing the better will be the result; for the clutch then will be disengaged and the brake applied automatically. The danger arises, however, when, as so often is the case, the right foot rests not on the brake pedal but on the accelerator. Instinctive bracing, which may come before the mind acts quickly enough to cause the foot to be shifted, then results in the car being rushed pell mell into the danger. The moral is obvious, and should be plain to the person of average intelligence without further dissertation.

A Telephone Transmitter Without a Mouthpiece

By H. R. Van Deventer

UNTIL the presentation of Prof. Whitehead's paper on the oscillations of a telephone diaphragm at the annual meeting of the A. I. E. E. at Boston last year, but little was understood regarding this important detail, and therefore practically all the commercial types of instruments have employed the same type of diaphragm as found in the very first instruments designed. The attention of most inventors has been directed toward refining and perfecting the structural details, and especially the resistance cell. Although this is a very important part, it is no more so than the diaphragm. Tyndall has found that the points of greatest vibration in a circular diaphragm clamped at its periphery are at a point midway between the center and the edge. Whitehead found that the diaphragm had two distinct motions, one superimposed on the other, one consisting of circular nodes and the other of oblique or diameter nodes.

A new transmitter is illustrated herewith which is the result of over five years of careful investigation of the properties of vibrating diaphragms. Instead of employing a loose diaphragm made of some dead metal, such as aluminium, which is commonly employed for the purpose, phosphor bronze is employed, which is rolled to produce an initial tension. The diaphragm is then formed, without drawing the temper, into a pan-shaped disk, the projecting edge of which is securely clamped, leaving the central portion free to vibrate like a drum head.

A resistance cell of the ordinary type is connected to the center of the diaphragm by means of a spider-shaped member having a plurality of feet which are soldered to the inner surface of the diaphragm. These feet, being equidistant from the center, pick up the sound vibrations at the maximum point, and it will be noted that this method of connection is entirely different from the ordinary method wherein the cell is connected to the diaphragm at the center. The cell with the diaphragm is placed in a back casing, the various parts being illustrated in the accompanying photograph. A connection is made between the front electrode of the cell and an insulated terminal carried on the casing in such a manner that the circuit is confined to the electrodes and granular carbon, so that no part of the casing or diaphragm is in circuit. Certain other details of construction, all very simple and easy of manufacture, result in an instrument which is absolutely water-tight, as it may be immersed in water for hours or even days without any damage whatsoever. The casing being of brass and the diaphragm of phosphor bronze, there is no corrosion such as commonly occurs in transmitters where aluminium diaphragms are employed.

As the sensibility of the instrument is considerably increased by the improved diaphragm construction, it is possible to dispense with the usual mouthpiece as commonly employed. Telephone companies figure, especially in the case of desk sets, that the annual maintenance cost for mouthpiece replacement is as high as 50 cents per telephone. The new instrument eliminates this charge, as the mouthpiece consists of a flat perforated metal guard which is practically indestructible.

Being water-proof, this transmitter offers a perfect solution for the troubles met with in mine and railroad telephones, police boxes, testing sets, and instruments used in other exposed locations. It can be used in the operating rooms of hospitals, as it can be flooded or immersed in a sterilizing solution without injury. The cell, being in an air and water tight chamber, cannot deteriorate, and being directly surrounded by the metal casing, interior air spaces being reduced to a minimum, the heat due to the passage of current through the carbon is rapidly dissipated.

The sanitary features of this new instrument should be evident; the mouthpiece can be thoroughly cleansed, and as it is flat, it will be often wiped off, which is not the case with the usual funnel-shaped mouthpiece. From tests made in several of the university laboratories and by the writer, the instrument, in its commercial form, was found to average from three to seven miles better in terms of standard cable than transmitters of ordinary construction.

The accompanying photograph represents the transmitter without guard or back shell, submerged in a fish globe filled with water. The looking glass, behind the globe, reflects the rear casing and attached wires. This exhibit was shown at the meeting of the National Independent Telephone Association at Chicago, Ill. The transmitter was connected with a testing set, adjusted for use on a long distance telephone line and operated by two sets of fifteen dry cells, each set in series, and both sets connected in multiple. The room at the hotel was fitted with the usual telephone subscriber set, and the submerged transmitter, through the testing set, was connected with the city telephone line. The Chicago operator was requested to connect with a certain office in New York and the following tests were made:

Talking in an ordinary tone, six inches away from the fish globe, against the submerged transmitter, a conversation was carried on for over five minutes and New York reported that the transmission was perfectly distinct, and that the voice was heard in natural tones.

Telephoning from Chicago to New York with a submerged transmitter.

Following the conversation a repeating watch was held against the side of the globe and the striking of the hours and quarters was distinctly heard in New York. The transmitter was submerged from 3 P. M. Monday, February 17th, until the close of the convention, Thursday, February 20th, 6 P. M., or 75 hours. Then it was taken back to New York and again submerged in a globe of water, giving perfect transmission.

The Anesthetizing Machine of Prof. Dubois

By Jacques Boyer

IN a recent communication to the Academy of Sciences of Paris, Prof. Raphael Dubois opposes the method of producing anesthesia by way of the alimentary canal, which has lately been proposed by various writers, and shows that his anesthetizing machine, herewith illustrated, offers the most certain and most uniform means of administering chloroform.

The anesthetizing machine invented by Prof. Raphael Dubois of Lyons, France.

The apparatus comprises a pump, an automatic device for introducing a measured quantity of the anesthetic, and a chamber in which the dose is evaporated. The pump has a piston of peculiar construction which is moved by turning a handle. At the end of each stroke of the piston a definite volume of air enters the pump barrel, carrying with it the vapor of the measured quantity of anesthetic that has been automatically poured into the evaporating chamber by the descent of a plunger into the vessel containing the liquid anesthetic. In the return stroke of the piston the mixture of air and vapor is expelled from the pump and replaced by an equal quantity of a precisely similar mixture. In this way a continuous flow of he standardized mixture can be maintained.

The mask with valves, which is commonly used when the anesthetic mixture is drawn from a gasometer, and which may cause accident through derangement of the valves, has been replaced by a valveless mask, which allows the patient to breathe, without annoyance, in a current of air containing a known and constant proportion of anesthetic. In this method no danger attends an excessive rapidity of administration of the mixture, and the only inconvenience caused by supplying it too slowly is the possibility that the patient may be roused from the anesthesia by the inspiration of fresh air.

At the beginning of the operation the plunger is raised to the top of its course, the liquid anesthetic (chloroform or ether) is poured into its container and the handle is turned until the lower face of the plunger touches the liquid. The operator then applies the inhaling mask to the face of the patient and turns the handle until the dose of anesthetic has been expelled into the evaporating chamber.

After anesthesia has been produced a buccal or nasal tube, or the tracheal cannula which the photograph shows lying on the glass table of the apparatus, may be substituted for the mask, if an operation is to be performed on the face.

The advantages of the method of Prof. Dubois are manifold. In the first place, the surgeon knows exactly how much anesthetic is being administered, which is not the case when the liquid is introduced by manual methods, even when it is applied in drops with a registering pipette. In the second place, anesthesia is produced in a regular and continuous manner. This arrangement is particularly important for the prevention of vomiting, which is a symptom of return to consciousness. Finally, the excitement attending the initial stage of anesthesia is entirely eliminated, or, at least, greatly shortened and diminished, even with alcoholic patients. The applications of the machine which have already been made have proved the correctness of previously published appreciations of the production of anesthesia by mechanically compounded mixtures, and it is possible that the majority of surgeons will decide to employ this thoroughly scientific apparatus.

A New Theory of Sleep

THAT we sleep, not because we are exhausted, but in order to avoid being exhausted, is the way in which the Geneva physiologist, Claparède, formulates a new theory. According to this conception, which has been further elaborated by Trömner, sleep is not the result of fatigue, but an impulsive self-disinfection process, which the body from time to time conducts against itself, so to speak, in order to get rid of waste products before they have a chance to become injurious. This view is expounded in an article by Dr. Adolf Koelsch in *Die Woche*.

He draws attention to the fact that just as combustion of fuel for the production of heat and energy is always attended by ashes and slag, so the slow combustion which produces heat and energy in the body by means of metabolic changes, is likewise attended by waste.

We read: "Since the senses never come to rest voluntarily or shut themselves off from the outer world, a point would eventually be reached when the organism would perish as a victim of general nerve exhaustion.

"In order to hinder this, Nature arranges betimes, i. e., before exhaustion can seriously injure the organism, to set in motion that opposition current which we term sleep."

Again, "The sight-endowed animal tends to take its sleep at night, since the stimuli which govern the animal's vital activities are then cut off."

For animals endowed with other special senses, but not with sight, the night is not so great a factor. "These can only blockade stimuli to the senses either by creeping into some secluded spot or by the action of Nature in causing an opportune production of a substance (a sort of *hormone*) which acts as an obstacle by entering the nerve path and deadening sensibility. There are numerous indications that the latter is what actually takes place."

It is believed that a sufficient degree of satiation is one of the influences which create such an obstruction, but the whole subject is still in need of extended investigation. Koelsch has also studied insects with confirmatory results.

Seeing Under Water

How Things Look From a Fish's Point of View

By the Berlin Correspondent of the SCIENTIFIC AMERICAN

OCEANOGRAPHY, thanks to the many investigations made from a geographical and physical viewpoint, has, during the last few decades, made enormous strides. We are now able, e. g., to gage with a fair approximation to truth, how light is distributed in the depths of the sea or a lake, what gradations of light and color are to be expected at certain depths, and what are the conditions of temperature from the surface down to the bottom. However, nobody seems so far to have examined in a comprehensive manner the question as to what an eye placed below the surface of the water would see and perceive, and what impressions it would receive from this rather unusual standpoint, of its immediate surroundings in the water, but especially of the world outside.

The experiments recently made on vision below water by a German scientist, Dr. Otto Baron v. u. z. Aufsess of Munich, are therefore of more than passing interest and likely to appeal to the physicist as well as to the fisherman and angler.[1] In order better to understand their purport it will be as well, by way of introduction, to summarize the physical conditions on which vision is based:

It is well known that a beam of light striking a transparent substance (e. g. water) of different density from air, undergoes at the boundary a variation in its direction, on account of the difference in the velocities of light in different media. Again, the ratio between these velocities in two given media is a constant figure known as their index of refraction, which is expressed by a mathematical relation between the angles of incidence and refraction respectively. Since a beam of light entering air from water under an incidence of 48½ degrees is broken along the water surface, those beams which come from angles greater than 48½ degrees can no longer issue into the air, but are reflected in their entirety from the water surface, the limiting angle being called "angle of total reflection."

What, then, may we expect to see on entering the water of a lake and trying to view the outside world from this unwonted position? Presuming the water surface to be perfectly calm, we immediately witness the following remarkable phenomenon: Whereas all objects immediately surrounding us in the water are seen in their natural size and shape, anything situated outside the water, i. e., the whole of the outside world, appears strangely deformed. It is true that objects situated vertically above our heads, i. e., in the zenith (clouds in the sky, etc.) have preserved their true shape; but as our gaze sweeps down toward the horizon, objects will change their wonted forms until at the horizon itself all vertical distances have become so greatly shortened that nothing can be recognized.

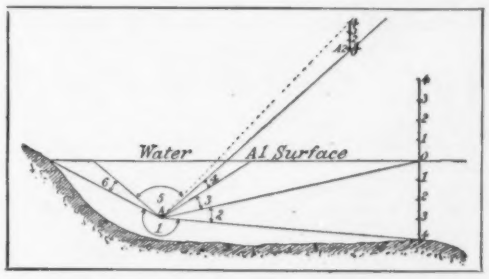


Fig. 1.—Diagrammatic explanation of underwater vision.

What is the reason of this strange phenomenon? In connection with our reference to total reflection we have seen that there are no visual beams connecting the water and the outside world, beyond an angle of inclination of 48½ degrees. In fact, the whole hemisphere of 180 degrees, constituting the outside world, is reproduced in the water within a cone of 97 degrees. While a fish thus is able to see all objects of the outside world—even an angler coming toward the water's edge—he sees everything, with the exception of the zenith, deformed and on a shortened scale. Moreover, the cone of 97 degrees just referred to is, at the limiting angle of total reflection, lined by a colored fringe due to the dispersion of colors in water, the red edge being turned downward and the blue and violet upward.

The horizon of water dwellers thus is extremely limited as compared with that of dwellers in the air, while even the form and size of objects in the air appear to them different from what they do to us. However, a person placed in the water will be even more surprised on viewing an object situated partly in air and partly in water.

Let us first consider an ordinary measuring-staff, as in Fig. 1, half of which is situated in water and half in the air. An eye placed under the water at *A* sees the submerged portion in its natural shape and size within the angle 2. The portion outside, however, becomes first visible in the cone corresponding to total reflection (angle 5); the upper portion of the staff thus appears in the direction of the limiting angle of total reflection. Being situated immediately above the water horizon, the whole of this portion appears extremely shortened, in fact, as a small object far distant from its direct continuation in the water, in an oblique direction above the water surface. Thus the staff is seen as two separate and altogether dissimilar parts.

Within the angle 3 is seen the *reflection* of the lower portion, and in the angle 4 the remaining lower surface of the water up to the limiting angle of total reflection. In the angular space 1 the eye sees the bottom of the lake from the staff to the bank, and in 6 the reflection of parts thereof.

Observation with the naked eye under water is unsatisfactory because it is impossible to stay under until the surface is undisturbed and one must limit himself to observing his immediate surroundings in the water. As his eye is only adapted for vision in air, all objects, on account of the different refraction of the water, will appear hazy and without any sharp outlines. The hands and body will have a sponge-like, jelly-fish-like appearance, even the stones on the bottom looking like parts of a pulpy mass. Any more distant objects,

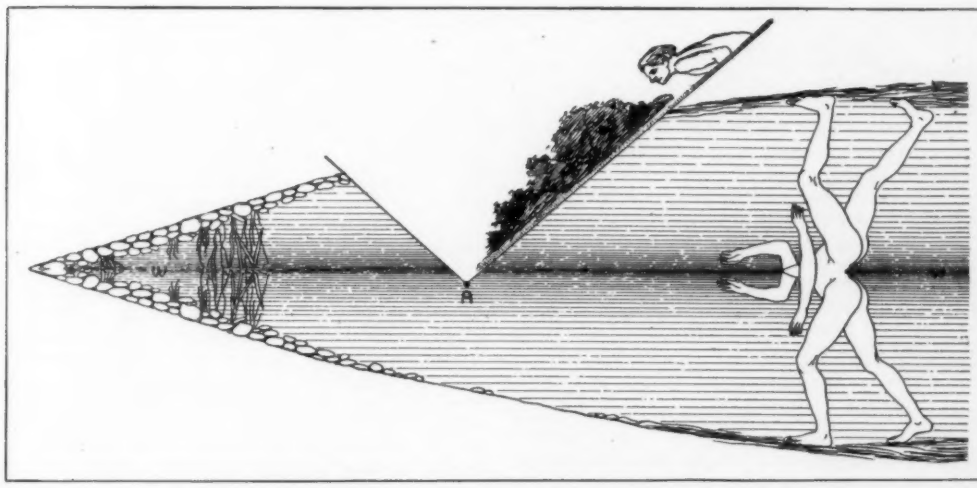


Fig. 2.—How objects are distorted when viewed from a point under water.

The eye *A* placed under the surface *W W* sees a four-armed and four-legged monster entirely disconnected from the head and upper body.

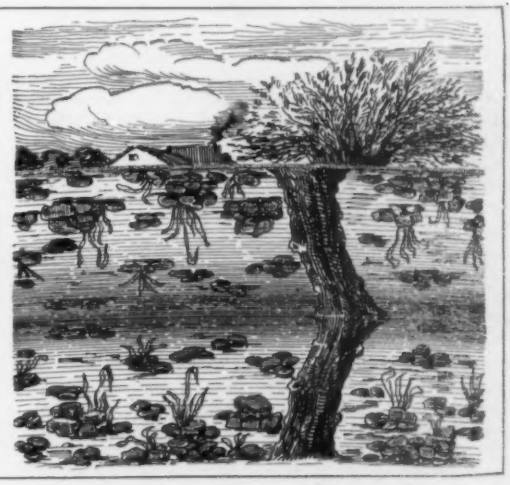


Fig. 3.—View from under water of a partly submerged tree.

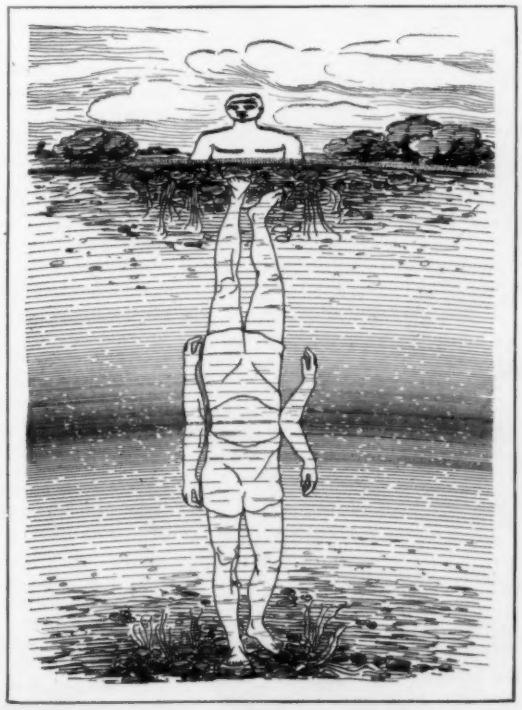


Fig. 4.—How a man standing in water looks to a fish. The limbs are doubled by reflection while the disconnected head is flattened by refraction.

From *Illustrated London News.*

Fish-eye view of a heron walking in water.

From *Illustrated London News.*

Note the reflection of the heron's legs on the under surface of the water.

[1] *Deutsche Alpenzeitung*, January, 1913.

for instance, the body of another human being, will appear quite indistinctly, as though through a dim green glass or a greenish haze. Such are the results of Baron Aufsess' actual experiments in the particularly clear water of the Walchensee.

But he has made more interesting observations by means of a mirror placed under the surface.

It was interesting to ascertain whether the silver-white armor of scales surrounding the abdomen of fishes is an outcome of adaptation to a bright reflex actually existing at the water surface, the fish becoming practically invisible to their foes. The supposition that such a reflection would be visible on the surface wherever on account of total reflection no light is allowed to come out of the water, was found to be erroneous, the water surface being even darker than the surroundings and showing the color of the lake (green or bluish-green). On the other hand, the circle corresponding to the cone of outside vision is extremely bright, and if the surface be even slightly stirred, each wave will produce a flickering glimmer so that a fish in this region doubtless becomes invisible to his foes, on account of his silver armor.

As regards the appearance of outside objects, houses and trees situated close to the water's edge are hardly recognizable as such, so flattened do they appear, while their lower portions are entirely invisible. Nor are the stones at the water's edge seen any longer; in fact, the roofs of the houses and the tops of trees look as though they rose directly from the water. Even high mountains appear from the middle of the lake as though they were slightly more than low eminences or at most flat hills. Most comical, however, is the appearance of a man standing nearby at the water's edge; his legs nearly up to the knees disappear, only the body being visible from this point, but compressed like a ball. What wonderful colors are, however, shed over this man and his surroundings! His face, arms, hands—in fact everything—is shining in the most beautiful colors of the spectrum, each bough of the adjoining trees, every leaf, is surrounded by a spectrum of its own, so that one could believe the trees to be dotted with shining rainbow pins. Wherever the bright sky is visible through the boughs, red, yellow, green and blue draperies are seen. The distant mountainous banks of the lake appear so flattened as to look like a dark horizontal stroke, but even they have their colored fringe, though only the red and yellow can be distinguished. If, now, the mirror be placed somewhat more obliquely, the true shape of an object is seen to be rendered the more faithfully as it is situated closer to the zenith. Still, it retains the wonderful colored edges above referred to.

Fig. 2 represents the impression received by an eye placed in very clear water, of a man walking up to his hips in water. Will the monster approaching the observer be recognized as a human being? In accordance with the broken appearance of the measuring staff (Fig. 1), the water dweller sees the part of the human body immersed in the water, walking on the bottom of the lake in its natural size and shape. This part of the body, however, is reflected at the same time from the lower surface of the water, thus producing an identical though reversed image with the feet pointing upward as a continuation of his lower body. The upper body, which emerges from the water, first becomes visible in the angular space corresponding to total reflection inside which the outside world is reproduced. It is thus seen from the eye *A* upward in an oblique direction in such a manner that above a colored band on the water surface only the flattened upper parts of the body are visible, surrounded by a luminous colored edge, all the remainder having disappeared. In fact, the man will produce on the water dweller the impression of a strange being. Fig. 4 shows a front view of the same phenomenon. The view toward the stony bank of the lake (Fig. 2) is likewise remarkable. On account of the similarity of the reflection with the real picture of the lake bottom, the eye seems to look into a tapering narrow slit paved with stones on the top and beneath, above which the water's edge appears in the same manner as above described. The reflecting water surface is only visible where it comprises bubbles or floating objects.

Another method of studying underwater vision was described in the SCIENTIFIC AMERICAN of December 28th, 1912. It involves the building of a subaqueous chamber from which fishes may be watched and photographed. Herewith are two underwater photographs taken by Dr. Francis Ward, showing a heron walking in the water. The mirror effect of the surface of the water is clearly brought out, although the reflection is not perfect because of the ripples stirred up by the bird.

The Aeronautical Society's Coming Aviation Meet

A THREE-DAY aviation meet will be held at the grounds of the Aeronautical Society at Oakwood Heights, S. I., N. Y., beginning on May 30th. Lieut. Riley E. Scott will demonstrate his bomb-dropping apparatus with which he won the Michelin prize in France last summer, and Cecil Peoli, Capt. Baldwin's youthful aviator, will blow up a paper fort by means of wireless electric waves sent from his biplane. George Dyott will make flights in his new monoplane, and the new following-surface monoplane of H. G. Nichols will receive its initial try-out. Shooting at small free balloons from an aeroplane will be attempted again and Lapham will jump from Harry Brown's Wright biplane in mid-air and again demonstrate Leo Stevens' new "safety pack"—a light silk parachute worn like a knapsack and which opens automatically almost the instant the man leaves the machine, and without his doing anything whatever. Every aviator and passenger should wear one of these "air" life preservers in case of a fall.

A Straight Line, Apparently, Not Always the Shortest

LIKE all good puzzles, this one is very easy when you know how.

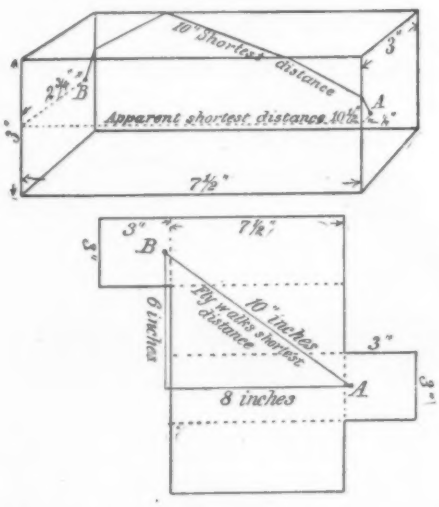
Suppose there sits upon a table a six-sided block of glass which is 7½ inches long and 3 inches each wide and high.

On the right hand end, at a point one fourth inch from the front and half way between top and bottom, sits a fly.

He is required to crawl, over the outside of the block, to a similar point diametrically opposite the one he now occupies, on the other end of the box.

He is a very lazy fly, and has a strong desire to crawl as little as possible.

What is the least possible distance he can cover



Showing that sometimes a straight line is apparently not the shortest distance between two points.

in getting from point *A* to point *B*? (See sketch.)

This looks easy. It seems obvious that the fly has only to crawl straight out to the front, straight along the front of the block and straight back along the left hand end, to make a perfectly straight line between the two points. A moment's thought will show that he crawls one fourth of an inch on the first end, seven and one half inches on the front, and two and three quarters inches on the other end—total, ten and one half inches.

But a really clever fly would crawl from point *A* to point *B* without covering so long a distance!

There are plenty of paths the fly *can* choose. He can crawl diagonally from point *A* to any other point he chooses and take another diagonal from his first turn; he can crawl along the edge and over the corners; but how can he select a course which will be less than ten and one half inches?

Having puzzled your friends with this, take a piece of paper and lay out a diagram (see second sketch), which is the block "unraveled," or taken apart, and on a "scale" of one quarter of an inch to the actual inch. By cutting this figure out of paper and folding it along the lines, it can be made into a representation of the glass block.

If, now, you will draw a line from point *A* to point *B*, and measure that line, you will find that it totals exactly ten inches the fly had to crawl over. Yet when the unraveled box is folded, it is obvious that it would take a very clever fly, and a clever boy, too, to think out the apparently devious line of travel which is, in reality, the shortest distance between the two points.

But, in spite of the apparent contradiction of mathematics in this little puzzle, it is strictly according to the letter of the law, for the line from *A* to *B* is to be regarded as the hypotenuse of a triangle, of which the sides are lines drawn from *A* and *B* and meeting at right angles. Measure these sides in your scale and you will find that one is eight inches and the other six inches.

Now, the hypotenuse of a right angle triangle is the square root of the sum of the squares of the sides. The square of six is thirty-six, the square of eight is sixty-four, their sum is one hundred, and the square root of one hundred is ten—which is the distance from *A* to *B* in your unraveled block.

Transporting a Locomotive on a Cableway

AMONG the problems confronting the engineers who are constructing in the West the enormous storage dams for irrigation, transportation of heavy machinery is one of the most difficult. The location of the sites for these dams is usually in a region remote from railroads and often quite inaccessible until highways have been carved out of the steep-walled canyons.

Arrived at the site of the big work, the moving of heavy machinery and materials from one side of the canyon to the other is a problem calling for considerable ingenuity and nerve on the part of the engineer. In late years wonderful progress has been made by the manufacturers of cableways and their efficiency has increased greatly. To-day the cableway when properly installed becomes the great transporter and solves in a large measure the difficulties which are encountered when working in deep canyons through which flow turbulent streams.

The series of cableways erected at Elephant Butte, New Mexico, have been employed to weighty advantage in transporting many thousands of tons of material and machinery. Recently it was found necessary to transfer a 20-ton dinkey engine across the canyon. The method employed is shown in our frontispiece illustration. Fearing the weight of the engine might too severely test the strength of a single cable, the engine was swung across on two cables and was safely landed at its destination on the other side. The length of the cableways from one tower to the other is 1,450 feet and the height of span above river bed is about 280 feet.

The Elephant Butte dam, which is to be one of the greatest works of the Reclamation Service, blocks the entrance to a comparatively narrow walled canyon in the Rio Grande River, about 120 miles north of El Paso, Texas. The structure will be of rubble concrete gravity type built straight and not curved like the Roosevelt dam in Arizona. It will have a maximum height of 275 feet, will be 1,200 feet long on top and contain 500,000 cubic yards. The reservoir created by the dam will have a superficial area of 40,080 acres and a capacity of 2,627,000 acre-feet. The reservoir will have a capacity of 39,025,600,000 cubic feet more than that of the Assouan in Egypt. It will serve a double purpose in that it absolutely protects the lower valley from destructive floods and insures an abundant water supply to 180,000 acres of land in New Mexico, Texas and old Mexico. It will restore to cultivation and intensive agriculture thousands of acres which have been abandoned by reason of water shortage. It will provide homes on the land for 3,000 families and increase the taxable wealth by many millions of dollars.

The Current Supplement

THE old-fashioned gold miner has been succeeded by a steel monster which digs out in one minute more earth than the huskiest man could have uncovered in a day. The largest mechanical gold dredge in the world is illustrated and described in this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT.—Extracts from the report of the American Consul General at Berlin, on the conditions of aeronautics in Germany to-day, brings much valuable information to those interested in the newest branch of engineering.—An oscillating propeller for ships, which is claimed to possess certain advantages over the screw propeller, is described by its inventor, H. C. Vogt of Copenhagen, Denmark.—In wireless telephony it has been found necessary to substitute for the Hertzian oscillator a generator adapted to furnish currents of such high frequency as 200,000 cycles per second. Such a generator is described by Mr. E. F. W. Alexanderson.—Dr. H. Warth illustrates by means of examples—one thousand analyzed rocks—a new system of classification for igneous rocks, based upon their chemical composition.—An article by Mr. F. A. Perret on the lava fountains of Kilauea is illustrated with some very fine photographs of lava streams obtained by means of a telephotographic lens.—J. S. Stone's article on the propagation of high frequency electric waves along wires is concluded in this issue.—Mr. P. Q. Keegan writes on the chemical nature of Floral Blue.

The Iceberg Patrol.—It is announced from Washington that the revenue cutters "Seneca" and "Miami" have been detailed to patrol the transatlantic steamship lanes to protect shipping against icebergs, supplementing the work of the British whaler "Scotia," a notice of which we have already published. Daily wireless reports will be made to the Navy Department.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The History of the Arch

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 19th there appears, in the article on "Babylonian Excavations by the Germans," the following statements: "Though we have long been taught that the arch was of Roman origin, the arch of this sewer was perfect and symmetrical and from an age not far from 4500 B. C." If later and fuller research corroborates this date, this will undoubtedly be the oldest arched structure on record, though it is hardly true to give to the Romans any credit for the invention of the arch. Many very early brick arches have been found, notably at Nippur in Babylonia (in 4000 B. C.) and in Egypt at Rekakna (3500 B. C.), Dendera (in 3000 B. C.), and beside the Ramesseum at Thebes (13th century B. C.). The earliest known masonry arch has been found in a tomb at Bet Khallaf in Egypt and belongs, according to Prof. Breasted, to the 30th century B. C. Arches were, as a matter of fact, used all through the ancient world long before the Romans and were, as a matter of fact, invented by no one race. The wonder is that this form of construction was not known to the Greeks; though Fowler and Wheeler ("Greek Archeology," p. 181) mention examples as early as the fifth century. It is strange enough that pre-Hellenic Greece, whose relations with Egypt and the East have been proven, continued to rely on the clumsy corbeled arch; and more so that classic Greece, whose construction was so perfect in every respect, made no use of the arch, with which they must have been familiar, save in one or two isolated examples. Perhaps some one of your readers can explain the reason for this. CYRUS HAMMOND.

Balliol College, Oxford, England.

Kapok as Stuffing for Life-saving Appliances

To the Editor of the SCIENTIFIC AMERICAN:

My attention was drawn to an article in your issue of January 18th last about "His Mattress a Liferaft."

Inclosed I send you a booklet edited by the Department of Agriculture at Buitenzorg, Java, Dutch East Indies, wherein you will see that the best material for such purposes is the genuine kapok fiber (*Ceiba pentandra L.* or *Eriodendron anfractuosum D. C.*) growing in Dutch East India and also in the Philippines.

The German navy and many passenger lines are using Java kapok only. Lifebelts, lifebuoys, mattress rafts, deck chair cushions, waistcoats for sailors working outside shipboard, may be stuffed with it. It is not necessary that the cover be waterproof; the fiber alone will have buoyancy enough. J. BLEY.

Selokaton, Java.

A Plea for the Enlisted Marine

To the Editor of the SCIENTIFIC AMERICAN:

Your very able and timely article on "Reorganization of the Navy Personnel" is almost exclusively taking care of the officer; and while you are at it, why not break a lance for the "enlisted marine," who in numerical proportions surely is an item to be figured with.

At present the prospects of this latter class are indeed limited, and with a growing navy these prospects do not grow in proportion. Some means should be found to provide civil positions in the Government service for honorably discharged soldiers and sailors, similar to the practice in vogue in the German army and navy. The navy especially will always suffer for want of mariners because the pay is small and the possibilities of pleasant married life remote, while with some such arrangement as guaranteeing the honorably discharged men civil service preferment in police, court, land office, etc., inducements could be created which so far nowhere are offered.

Chicago, Ill. E. GAIDZIK.

The "Flame" Detector

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of March 15th appeared a note to the effect that the German, Leithauser, had discovered that a flame, especially if enriched by potassium salts, will act as a detector for wireless waves. It should scarcely be necessary to remind your readers that Leithauser is nearly thriteen years behind in his "discovery."

I observed this phenomenon in September, 1900, and it has been frequently described in scientific papers, especially in a paper presented by myself before the American Institute of Electrical Engineers in August, 1906. The "flame" detector was the first "hot gas" detector and the forerunner of the present audion, which is now known to almost every wireless man, especially in America. The flame and incandescent filament audions are covered by twelve United States patents, the basic one being No. 979,275 of December 20th, 1910, filed February 2nd, 1905. LEE DE FOREST.

Palo Alto, Cal.

"Moon-Farming"

By Charles Fitzhugh Talman

SCIENTIFIC men devote a deplorable amount of time to felling Antæus, in the shape of one or another of a host of irrepressible superstitions. Whether the giant happens to be the equinoctial storm, or unlucky thirteen, or the climatically omnipotent Gulf Stream, or the super-moon, the Hercules has not yet arisen who shall crush him conclusively in midair. Superstitions are to be dispatched in no such expeditious way, but die by inches and prolong their agonies over ages. The super-moon is waning; but its decrescent light will still glimmer in the dark places when our posterity has used up all the coal, and is doing undreamed-of things with radium.

It is elementary that, let any belief once get firmly rooted in the public mind, there is always plenty of evidence serving to confirm and perpetuate it. The well-known process of "counting the hits but not the misses" insures longevity to the grossest delusions. It is, therefore, not surprising that a certain group of superstitious opinions and customs connected with the moon, which pertain especially to rural affairs, and to which Prof. L. H. Bailey has applied the felicitous collective name of "moon-farming," having once been wellnigh universal, should still flourish in the back-blocks of civilization. It is, however, one thing to account for their present vitality, and another to explain how they came to gain such a hold upon the minds of men. Bailey has enumerated the more familiar of these as follows:[1]

"The pork from pigs killed in the old of the moon will shrink when cooked, but it will retain its size if killed in the new of the moon. Animals born when the moon is new or increasing will be much more likely to thrive than those unfortunately born at the opposite period. Fleeces will not be so heavy if sheared when the moon is on the wane. Meat decays with unnatural quickness if exposed to moonlight. In the new of the moon is the time to set hens, to plant corn and other things that grow above the ground. Planted in the old of the moon, seeds of such plants will probably rot. On the other hand, crops that grow under the ground, as potatoes and beets, should be planted in the old of the moon, and plants that tend to run too much to vine and straw also should be planted at this period. Beans planted when the moon is on the wane will not cling to their poles. Grain purchased in the full of the moon will be of full weight. Rail fences sink in the ground and rot if built in the old of the moon. If shingles are laid in the new of the moon the nails will pull out. Timber lasts longer when cut in the waning moon. My fireplace wood is 'sappy' because it was cut in the waxing of the moon. The moon foreshadows changes in the weather. It chills and injures plants on clear nights. In the full, it causes wounds to heal. It governs mental qualities, and all persons who are unsound of mind are to this day *lunatics*."

Some of these beliefs are easier to refute than others. Certain of them still have their advocates among the illuminati—as witness the fact that the alleged effect of moonlight in promoting the decomposition of fish and other animal substances has been actively debated back and forth in the English scientific journals during the past twelvemonth; and again that its alleged influence upon the flow of sap in trees, and hence upon the quality of timber, continues to this day to be a bone of contention among intelligent foresters and lumbermen. Certainly the consensus of scientific opinion is against both of these beliefs. Moonlight is nothing but the reflected light of the sun, with which it compares in intensity in the ratio of about 1 to 600,000; and it seems obvious that any effect of moonlight upon the physiological phenomena of animals and plants must be nullified, for practical purposes, by the preponderating influence of daylight. As to the heat received from the moon, it is absolutely insignificant, and can be detected only with the most delicate thermometric apparatus known to science.

Our present purpose, however, is not to investigate the truth or falsity of these and kindred ideas, but to show that their mode of origin bears no necessary relation to their intrinsic merits, and that the mere fact of their wide currency is by no means to be regarded as evidence that there is "something in them."

In industries of modern origin the moon does not figure. The locomotive engineer does not believe that the phases of the moon affect the running of his iron steed, nor does the telegraph operator consult the lunar tables in the almanacs before renewing his batteries. "Moon-farming" is not quite so old as agriculture, but it is exactly as old as astrology, and in the once universal belief in the mysterious influences of the heavenly bodies upon human affairs we must seek its beginning.

Primitive humanity was naïvely egotistical. Man was the center around which revolved the whole of creation; and if the sun, moon and stars were not a part of the machinery by which a superior power regulated human lives, why (asked our ancestors) were they set in the heavens? The argument implied in this question was unanswerable, and it only remained to find out just what rôle was played by each of the celestial bodies in the human drama. Now it is evident that the moon must have impressed the imagination of primitive man more strongly than any of the other heavenly orbs, not even excepting the sun. As compared with the latter, she undergoes rapid and striking changes in form; her times of rising and setting vary conspicuously from night to night; and for a few days, every month, she disappears from the heavens. It was, therefore, inevitable to regard the moon as the most active of the agencies controlling mundane affairs; and especially was it natural to link up the erratic behavior of the moon with the equally variable phenomena of the weather.

In a more sophisticated, but no less unscientific age the primitive moon superstitions were variously embellished and elaborated by the metaphysical processes of reasoning that then prevailed. A good example is found in Virgil's "Georgics." Here are enumerated the merits and demerits of the several days of the lunation, and it is explained that the fifth day after the new moon is unlucky because on this day were born Orcus, the god of the infernal regions; the Eumenides, or Furies; and the Titans, who revolted unsuccessfully against Olympus. Several other lunar superstitions are similarly connected with the stories of classical mythology.

An analogous process by which many moon myths originated is explained by Prof. Houdaille[2], who made a special study of the superstitions of this class prevailing among the French peasants. The new moon symbolizes youth, vigor, and luxuriant growth. Hence the belief that plants abound in sap during the increase of the moon, and that seeds planted at this time will produce abundant vegetation. On the other hand, the old moon is a symbol of maturity; plants grown for their fruit or seed should accordingly be sown at this time. The young moon is tender; the old moon tough. Hence when the moon is young, eggshells are easily broken through, and this is the favorable time to hatch chickens! The association of ideas involved in these doctrines recalls the old notion of "signatures" in medical botany, according to which a plant with heart-shaped leaves was good for diseases of the heart, and so on.

Just a word more as to the persistence of beliefs connecting the moon with the weather. These are the most prevalent of the moon superstitions, and to a certain extent they are fostered by science itself. Meteorologists are, to this day, at loggerheads as to what, if any, atmospheric fluctuations (aside from the undoubted but insignificant atmospheric tides, due to the combined pull of sun and moon) are attributable to the moon. The subject is a safe one for the trained man of science to discuss; but when the dilettante—and *a fortiori* the harebrained ignoramus—interjects his opinions into the discussion, the results are sure to be fantastic. The very fact that the most patient investigations have failed to establish conclusively the existence of any lunar period in the weather shows that, if the moon does affect the weather, its influence must be infinitesimally small, and, therefore, of no practical importance. The latter circumstance, however, is overlooked by the public, and controversies in reputable scientific circles have undoubtedly created the popular impression that the whole subject of the moon's influence on the weather is far from settled.

Lastly, sham science, which the public mistakes for the genuine article, is a most nefarious agency in perpetuating moon superstitions. A familiar example is the table for predicting the weather from the time of day at which the moon changes, known as "Herschel's Weather Table," so widely published in newspapers and almanacs. As a matter of fact, the great English astronomer was in no way responsible for this absurd production, which has borne his name for a hundred years.

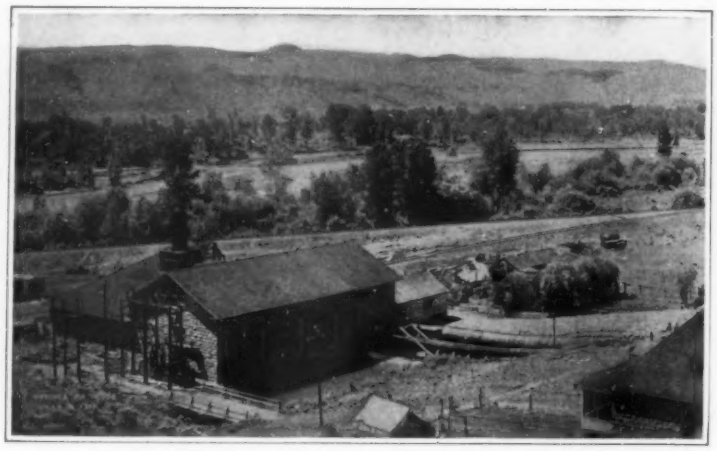
[1] *The Independent*, v. 67, 1909, p. 907 *ffg.*

[2] *Le soleil et l'agriculteur*, p. 521.

Gold-tin Cans

THE corrosion of tin cans used as food containers is sufficient to induce investigation. As a result of such study Gudeman has made a substitute for tinned iron that is nothing less than gold-iron. Tin or iron does not quite fill the pores, but gold alloyed with iron does this perfectly and makes an ideal food container—except for the cost, which is fifteen times that of ordinary tin plate. Gudeman applied a liquid amalgam of gold and mercury to the iron plate and then distilled off the mercury. The resulting plate looks like gold, resists acids like gold and is absolutely uniform and continuous in surface. It was also found that the pores of iron could be filled with enamel or even with glass if a pressure of 50,000 pounds to the square inch were applied, and the resulting product was just as resistant as enamel or glass.

Pipe lines from canal to Natches power house.



Natches power house—central station for a farming district.

Agriculture, Electricity and Irrigation

Intensive Farming Made Possible With the Electrically Driven Pump

By Putnam A. Bates, E.E.

BETTERMENT of the farmers' conditions and improved efficiency in all farming operations are the needs of the hour. Bankers and business men's associations, federal departments, agricultural colleges and important engineering organizations are giving careful study to this basic foundation of the country's welfare, and yet there is perhaps no one improvement that may be counted on so radically to benefit the farmer as the introduction of electricity on the farm.

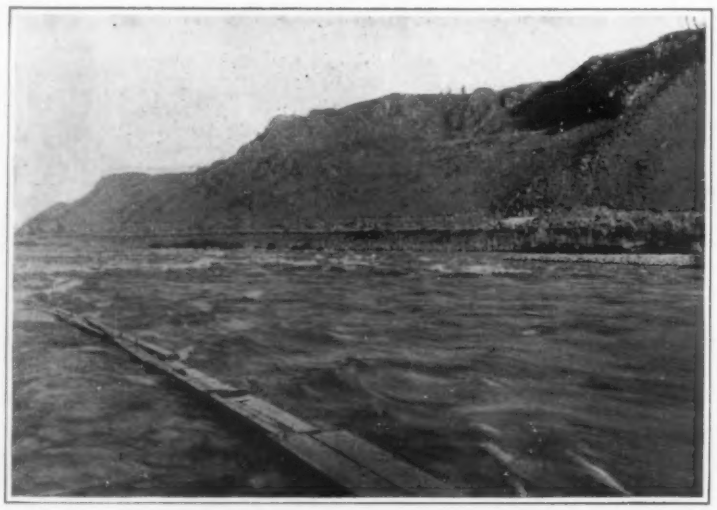
The electric farm, however, is not a new idea, for farms well worthy of this appellation have been in successful operation approximately for ten or twelve years. But there has been very little dissemination of existing knowledge of the use of electricity in agriculture, with the result that farms electrically equipped are under suspicion and regarded as impractical hobbies.

Here I shall endeavor to show that such derogation should cease at once, for we may look for a general use of electricity on the better class of farms in this country, before many years have elapsed, and electricity is now being utilized for lighting and power purposes on a much larger number of American farms than many of us realize.

Let us consider for a moment the farms of the Southwest. In some sections of that fertile country, well protected by the mountain ranges, are to be found many electric farms, with buildings lighted by electricity and many of the laborious operations accomplished by the use of electric power. There were our first electric farms, the period of establishment corresponding with the development of the water powers of the nearby mountains.

On the majority of southwestern farms, irrigation is practised, and naturally electricity was first made use of for pumping purposes. Next, under the influence of progressive operators at local central stations, it was generally introduced for light.

Captured waters—forebay of the power canal.



Turbulent waters of the Natches River above the intake canal.

I saw electric lights and electric flat irons in use in farm homes of the Pacific Coast eleven years ago. The people were content to enjoy the advantages which electricity from water power made possible to them, but did not seem to regard their advanced conditions as unusual. Their farms were, in fact, electric farms and their industries, dependent upon the produce of the land, were, as they are now, practically all operated by electricity. I refer to the canneries, fruit packing houses, etc.

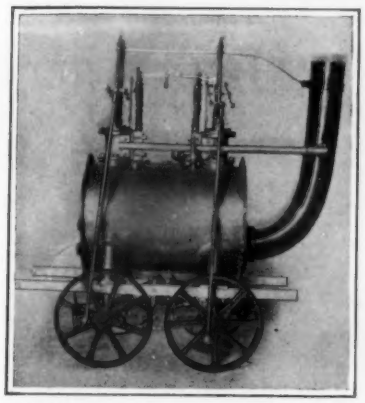
The conditions surrounding the farming districts in southern California, for example, at that time, were such that it would have been unusual to adopt any other form of energy; a combination of circumstances being largely responsible for this fortunate situation. The high tension transmission service systems were then new and the companies desired business, and we did not have the gas engines we possess to-day. The efficient and reliable gasoline and fuel oil motors were not developed until several years later. There was pumping to be done, for irrigation was rapidly coming into favor, and, naturally, the electric companies secured the business.

It is difficult to determine whether the power plants, supplying service at rates within the reach of all, made the irrigated farms, or if the electrical load, which these farms warranted, insured the success of the power developments. Both interests seem to have worked together, and in some instances practically the entire supply of the central station current was at once utilized for lighting, heating and power uses on the farms. This was the case ten years ago in the instances I speak of, and according to recent reports, the situation has not materially changed,

(*Concluded on page 479.*)

Pump house for irrigating an 800-acre farm.

Garden truck forced to early maturity by electrical irrigation.

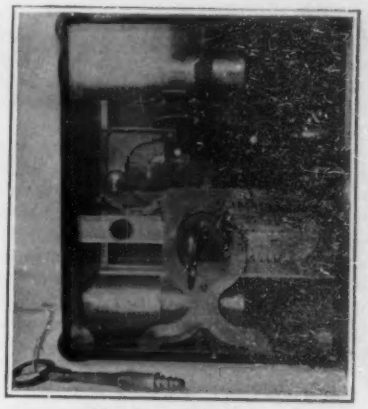


Model of Stephenson's engine, 1816.

Franklin Institute Treasures

Discovery of Keeley's Motor, the First Yale Lock, Franklin's Static Machine and Other Interesting Models in the Underground Storage Rooms of the Old Building

By H. D. Jones



The first Yale lock.

A RECENT overhauling of the contents of the cellars of the old Franklin Institute Building in Philadelphia has brought to light a number of interesting models that had been allowed to rust in out of the way corners of the underground storage rooms. Some of these proved so valuable, when examined by members of the Board of Management, that it was determined to select the more interesting for a permanent museum in the new building that the Institute will occupy in the future. The models thus selected have been cleaned and classified and many are now to be seen in the cases at the Institute.

Among the models is the original Yale lock, made by Linus Yale in 1855. It is a clumsy looking contrivance with a key big enough to match those of the old-time safe, but its principles were as sound as the perfected Yale lock of the present day. A writer with a turn for mathematical calculations spent a long time trying to estimate the number of arrangements of manipulations made possible by the lock, but found it would take more than a lifetime to enumerate them. The lock is a very ponderous affair, but it must be remembered that in those days the old idea that weight made strength still prevailed.

The story of the Keeley motor hoax will live long. Its interest will be enhanced by the preservation in the Franklin Institute of the model of the remarkable motor that Keeley built to deceive intending investors and enrich its inventor until the fraud was exposed after Keeley's death. For twenty-five years Keeley astounded eminent scientists of Europe and America with the machine that he claimed had solved the secret of perpetual motion. The inventor of this machine would start his device going, apparently, by playing a tune on a mouth organ. He convinced many clever men that he told the truth, and stock in the new concern sold freely. To the day of his death Keeley declared that his discovery was a genuine one, and it was only when the house in which the machine was placed was thoroughly overhauled that the colossal fraud was discovered. Keeley had wired the walls of the building. He ran his machine by high pressure hydraulic power. When the wires attached to the machine were the subject of investigation, Keeley would file them to show that they were solid and could not be used for any purpose other than that for which they were attached. Pieces of wire thus filed are to be seen at the Franklin Institute. The broken pieces show that the wires were hollow and that the inventor of the wonderful motor carefully stopped his filing short of perforating the center, which would have exposed the fraud.

There are several other perpetual motion machines in the collection, some of them deliberate cheats like the Keeley motor, some the creation of enthusiasts who miscalculated, but had faith enough in their ideas to carry them to the Patent Office for protection. One of the frauds is the Redheffer perpetual motion machine, which claimed to work on the principle that loaded cars on an inclined plane exercised a constant force to push away the planes. This force was supposed to rotate a large wheel. The model actually shows that the force used to deceive investigators of this method of overcoming the rules of nature was obtained through a small wheel, worked by clockwork concealed in the hollow of one of the posts. The clockwork was set going by winding one of the knobs seen in the photograph of the model. A humorist at the Institute has set at the top of the Redheffer machine a small model of a man trying to lift a trunk while standing on it.

More valuable from a scientific viewpoint than the models of the perpetual motion deceivers is the model of the Stephenson engine, showing the wheels supported on pistons working in steam cylinders instead of springs. The engine weighed about eight tons. The wheels were connected by a chain. The engine proved defective in

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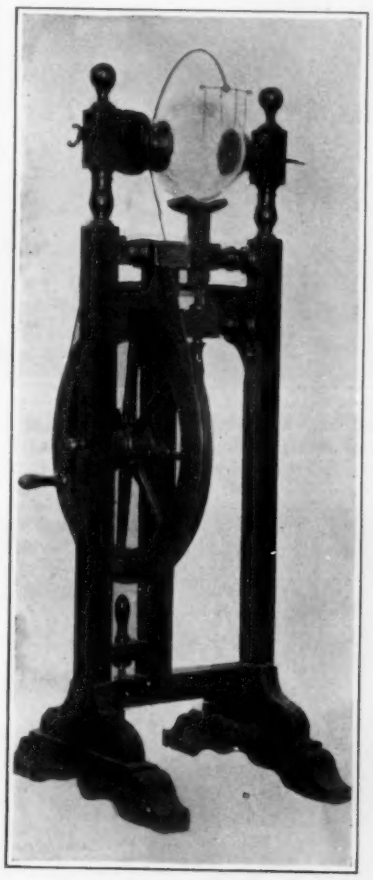
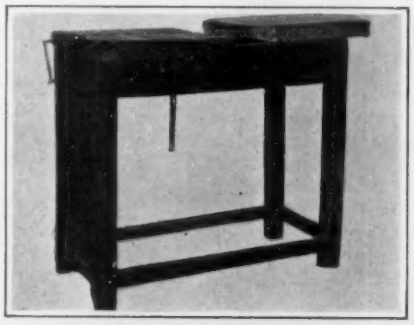
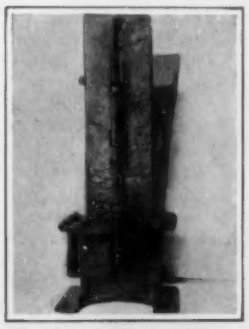


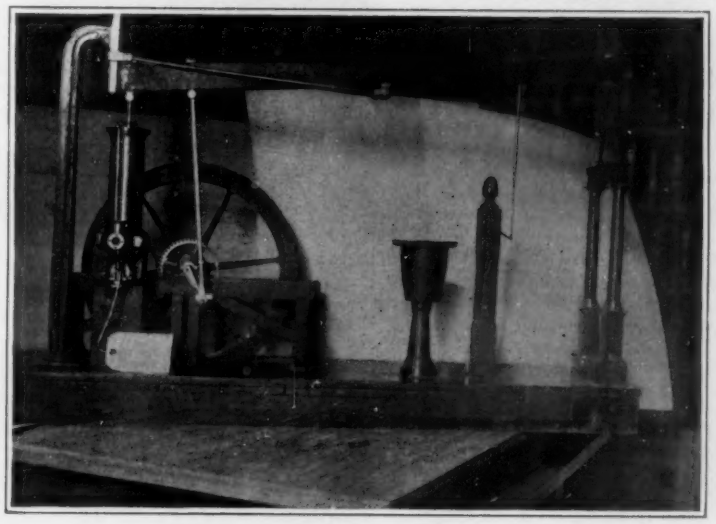
Franklin's static machine.



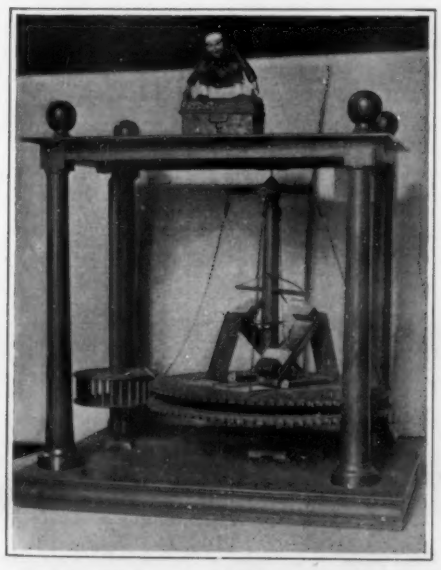
Franklin's bench for dressing type.



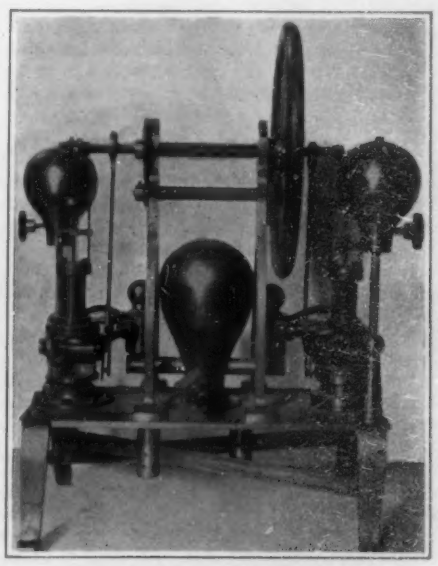
Brush's original arc lamp.



Oliver Evans' "Oructor Amphibolis."



Redheffer's perpetual motion machine.



Keeley's mysterious motor.

In anticipation of the vast benefits which will accrue to the maritime commerce of the world, and reflectively to the ports of the Caribbean Sea contiguous to the Isthmus, by the opening of the Panama Canal, some of the coast cities of Central and South America and the southern West India islands are energetically preparing to share in the prosperity that must attend the diver-

Improving a Harb

One Effect of the Panama

By Harry Chapin

HALF a million dollars are now being expended jointly by the colonial government of Curaçao and corporate interests of the island in the improvement of the harbor facilities of the famous seaport, which is distant 675 miles from Colon and forty miles from the coast of Venezuela.

Many of the neighboring tropical cities of island and continent have had to undertake not only the remedying of their port accommodations, but fairly to create a system of sanitation. Willemstad, however, has long enjoyed the name of "Spotless Town," because of the scrupulous cleanliness that distinguishes its streets and buildings and the thorough excellence of its water and drainage provisions.

The city of Willemstad is situated on the southerly shore of the island of Curaçao, at the easterly side of a strait, known as Ste. Anne Bay, which leads from the ocean into a great natural basin called the Schottegat, and the present scheme of improvement contemplates principally the widening and deepening of the channel approach from the sea and the construction of new docks. The strait, which now averages in its navigable width 120 feet, and in its depth from 60 to 80 feet, will be widened to 250 feet, with a minimum depth of 34 feet and of 60 feet in the channel proper.

Work upon the improvement was started by the colonial administration in October last, under the authority of a law passed by the Dutch Parliament and ratified by the Queen, and operations are now being actively furthered under the supervision of M. Zelle, director of public works of the Netherlands.

The removal of an obstruction to navigation in the Schottegat, in the form of a rocky ledge twenty-three feet under water, will complete the improvements that are to be undertaken by the government, and for which fifty thousand dollars have been appropriated. As the sides and bottom of the strait and the ledge in the basin of the Schottegat to be excavated are all of hardened coral, submarine blasting will have constantly to be resorted to in the accomplishment of the work.

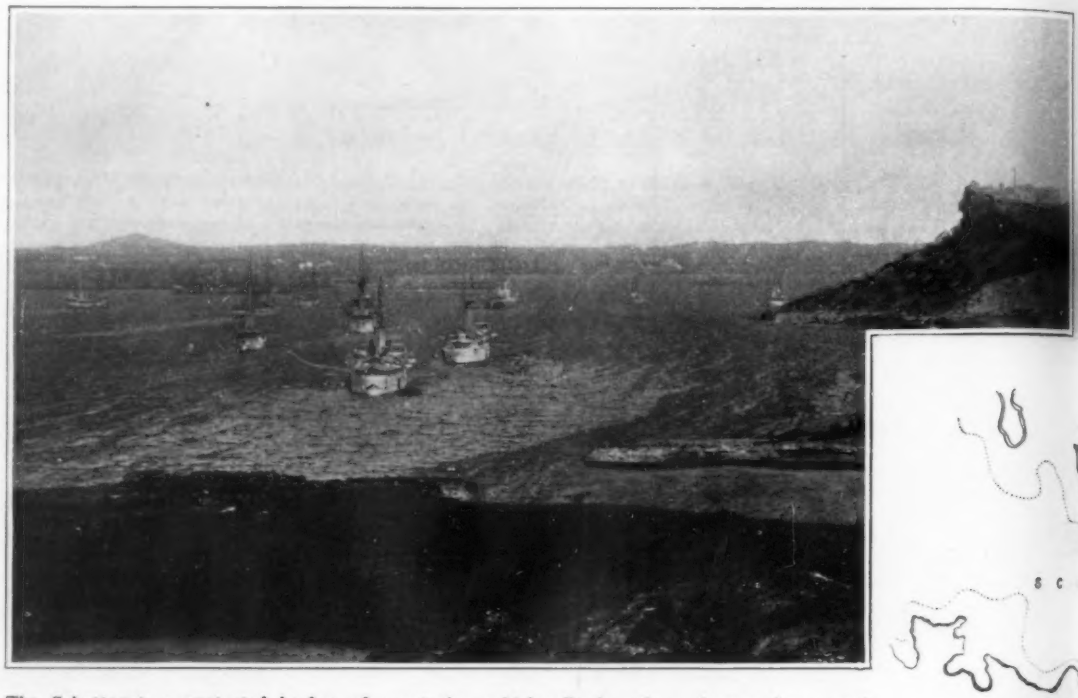
Conditional upon the actual commencement by the State of operations looking to the betterment of the harbor of Willemstad, the expenditure of private capital to the extent of $450,000 has been contracted for to further the development of the resources of the port, and included in this latter programme is the building of a wharf with about 1,200 feet of docking facilities to extend from the city frontage upon the Schottegat. Among the corporate interests of the colony which have contributed to this outlay are the Netherland Chamber of Commerce in Curaçao; the Royal Dutch West India Mail, a crown-subventioned steamship company that operates regular services between Willemstad and Havre and Amsterdam and intermediate ports in the Antilles and Paramaribo, Dutch Guiana, and New York; the Curaçaosche Bank, Curaçaosche Handelsbond (Curaçao Commerce Association and Curaçao Trading Company); and S. E. L. Maduro & Sons, a coal importing firm.

T. Greidanus, secretary of the Netherland Chamber of Commerce in America, of which Cornelius Vanderbilt and Stuyvesant Fish are directors, states in the annual report of that body that when the improvements at Willemstad are completed, the Dutch West India port will offer facilities for the provisioning and coaling of steamships plying in trades to routes *via* the Panama Canal such as are not to be had at any other point within a thousand miles of Colon. Coal is imported into Curaçao duty free, he states, and it has been demonstrated that two hundred tons per hour can be placed within the bunkers of cailing steamers, while the customs levy upon ships' supplies is so light as to render them obtainable at very reasonable prices. He points with pride to the fact that these advantages combine with the cheapness of labor and the safety, cleanliness and healthfulness of the city to make it a most desirable rendezvous for the disembarkation of passengers during coaling or loading operations.

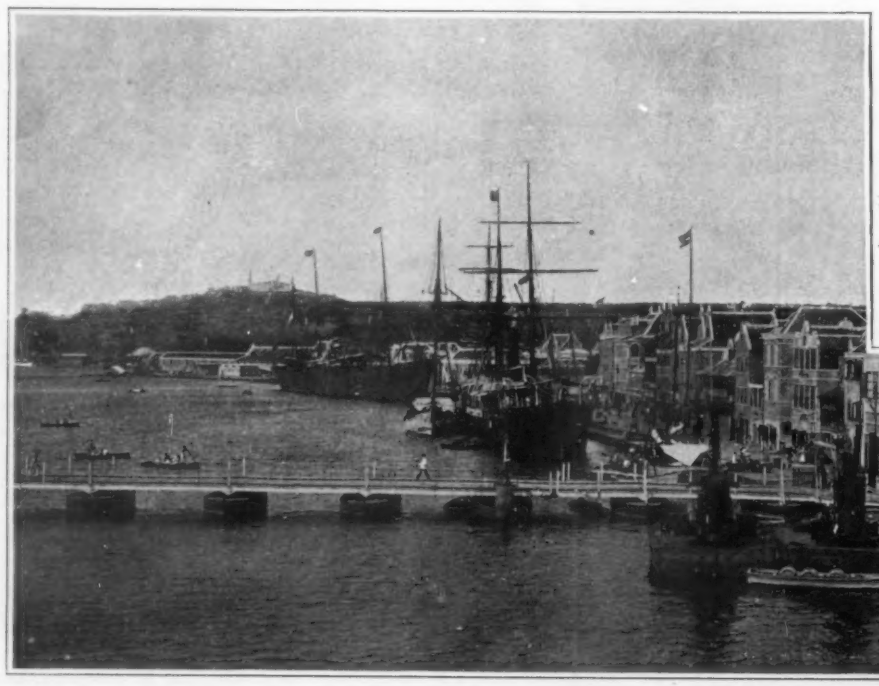
The city of Willemstad has always possessed a peculiar charm for American tourists, because the quaint Dutch architecture that prevails there is strongly reminiscent of the style of the buildings and dwellings of "Nieu Amsterdam" and the morning years of the settlement of Manhattan Island, New York.

It is known that during the time in which the proposed acquisition by the United States of the Danish island colony of St. Thomas was under consideration by the governments of this country and Denmark, the Dutch West India possession of Curaçao entered also into the deliberations of the Washington authorities. The proximity of the Dutch island to Panama was, of course, the prime factor in the suggestion that it might be desirable to add Curaçao to the other colonial dependencies of the republic.

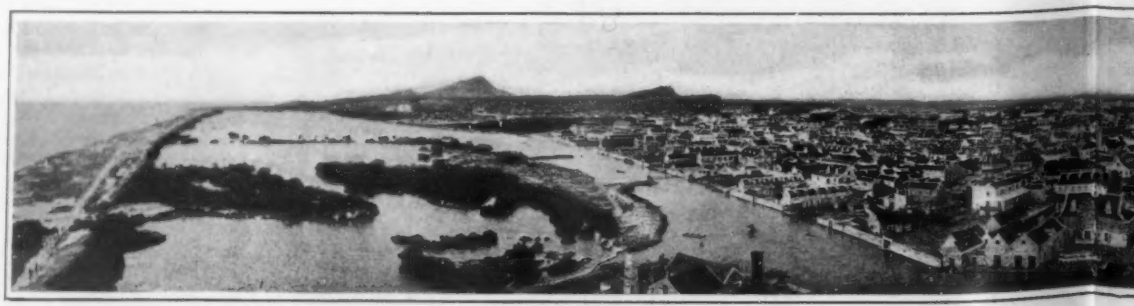
The result of a thorough investigation of the situation and the physical resources of the Island, however, convinced the Government that its strategic value was almost wholly commercial, and that while it might be desired as a naval base, its maintenance as such would be exceedingly costly, in that it would entail a greater



The Schottegat, a protected harbor of great size, which affords safe anchorage for a vast shipping. The removal of a coral ledge that forms an obstruction to navigation of this lagoon is one of the improvements now being undertaken by the government of Curaçao.



Willemstad's picturesque waterfront along Ste. Anne Bay, showing the characteristic Dutch style of architecture that suggests the early days of New York city.



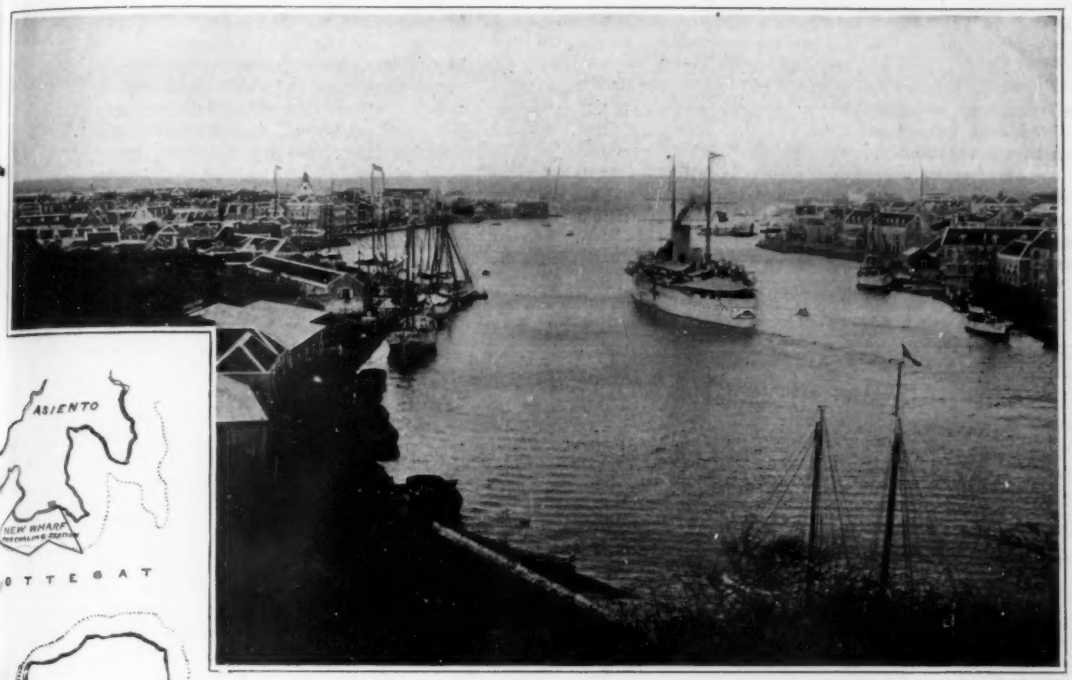
Willemstad, the capital and port city of the Dutch West India island of Curaçao, is divided into two sections by a strait called St portions of the town. The population is about 32,000, of whom 8,000 are centered at Willemstad, and embraces Dutch, Spani mento," which is spoken by the negroes, the majority of the population, is a jargon of the tongues of these several races.

Harbor of Curaçao

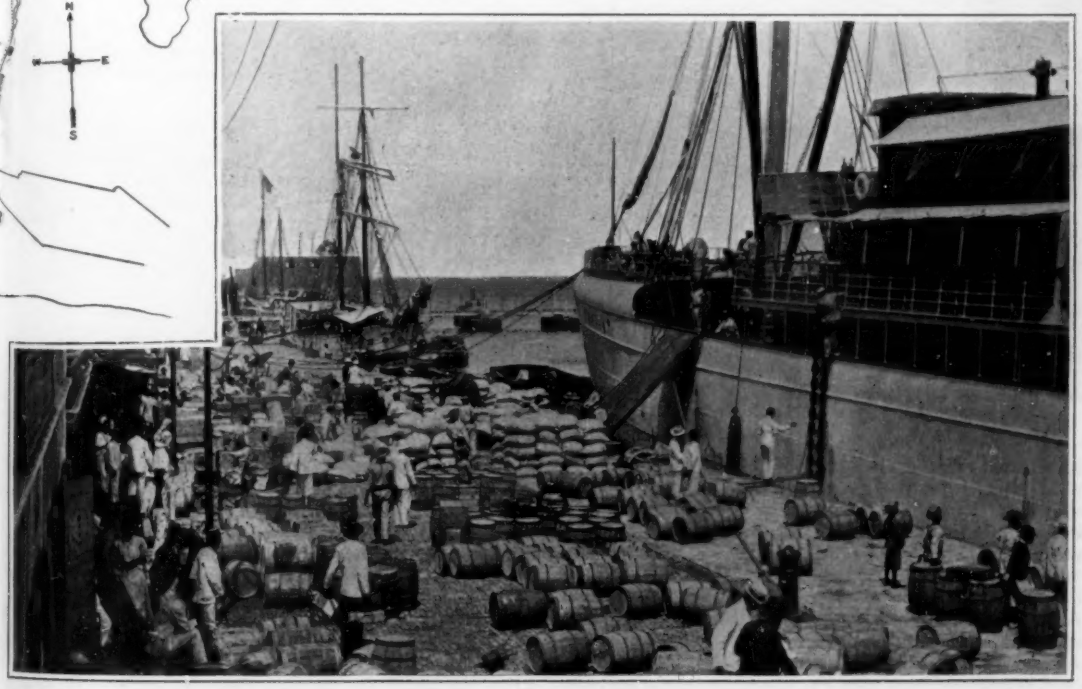
e Panama Canal's Completion

rry Chapin Plummer

sion of transoceanic traffic to the great waterway. One of the communities near the Atlantic entrance to the canal which is striving to gain headway over its rivals is Willemstad, the capital of the Dutch West India island of Curaçao. In this article the scope of the remarkable improvements which are now being made in that splendid haven are briefly and clearly outlined.—EDITOR.



Entrance of Ste. Anne Bay, looking seaward, the Dutch cruiser "Utrecht" steaming away from Willemstad. Moored alongside the wharves are a few schooners engaged in the local Caribbean trade.



that An ever-busy scene, peopled by motley throngs, is the quay at Willemstad by day and by night, for an excellent electric light system illuminates the waterfront after the sudden tropic sunset.

it called Ste. Anne Bay, leading from the sea to a huge lagoon called the Schottegat. A pontoon bridge connects the divided
tch, Spanish, English, French, German, and other Europeans and many Caribs, or native Indians. The patois, called "papia-
ral nces.

degree of protection than would compensate for its possible usefulness as a lookout point.

The recommendations that decided against the acquisition of Curaçao are understood to have been, in substance, as follows: Willemstad is an excellent port of refuge and repair for small vessels and torpedo craft, but Ste. Anne Bay is too constricted to permit more than six battleships to move at one time. It is exposed to gun-fire from the sea, and, moreover, by reason of its bottle-shaped entrance, it could easily be blockaded by an inferior force.

While the sanitary conditions are excellent, and coaling and repair facilities are as good as the average, the town is small, and for obvious reasons it is never deemed judicious to give liberty to a large ship's company at a small port, especially at an island port.

As for the strategic position of Curaçao, it is about the same distance from Colon as Guantanamo, the American naval station on the south coast of Cuba. It is expected that the entrance to the Panama Canal will be fully and amply provided with all docking facilities, coal and repair shops and that these, too, will be fortified.

Detecting Raised Checks With Ultra-violet Rays

A DISCOVERY of Dr. Robert W. Wood of the Johns Hopkins University has put forgeries out of business. The most skillful check-raisers have worked with chemicals, using a chemical ink eraser to remove portions of the written matter upon a check and then inserting what they wanted to insert in a handwriting that so closely imitated the original that it was almost impossible of detection. As the chemical erasers removed ink from paper in such a manner as to leave no trace of what had been written and made no change in the texture of the paper it was considered next to impossible to discover any change.

However, Dr. Wood has found that the change may be detected by photographing the suspected check by means of ultra-violet rays. He has a piece of paper on which the words "Twenty-four hundred dollars" appear. The words were originally "Twenty-four dollars." The change was made by an expert who had erased the word "dollars" and the line after the "twenty-four" with a chemical ink eraser and had written the words "hundred dollars" in a manner so perfect that it was impossible to discover any change in the line, even with the aid of a high-power magnifying glass. Dr. Wood took the slip of paper and put it under his ultra-violet rays and photographed it, giving it a ten-minute exposure. The result is that a heavy smudge appears before the words "twenty-four," clearly showing that something has been erased and something else written in. The explanation is that in removing part of what has been written a stain was left, invisible to ordinary light, but shown clearly by means of the ultra-violet rays.

Dr. Wood's discovery will be of especial advantage in discovering changes made in documents, such as wills, where it is desired that the knowledge that anything is suspected and that an investigation is being made be avoided. It is now possible to discover if a certain sort of chemical has been used by making tests with other chemicals, but the result of these tests is to change the document. Dr. Wood's method makes absolutely no change in the document itself, but the change, if any has been made, shows plainly on the photograph taken by his method.

Tests of the New Navy Flying Boat

PRACTICALLY all the tests specified for the new navy flying boat, which has just been completed by Burgess Company and Curtis of Marblehead, Mass., were completed on the 13th instant, by aviator Frank Coffin, accompanied by Lieut. Murray, U. S. N., as observer. The tests were made over a five-mile triangular course in a wind of six to eight miles an hour at the start, but increased to about 10 miles per hour at the finish. Forty-eight gallons of gasoline were carried. The aeroplane rose easily from the water within 1,000 feet, although it had 1,500 feet in which to start under the specifications. The hour's endurance test lasted an hour and eight minutes, after which the machine rode at anchor in the open sea for half an hour in fulfillment of this test. The speed test was the only one uncompleted on the 13th. This new machine is of the flying boat type, in which the aviator sits just in front of the lower plane, which is slightly lower than his shoulders. The motor, a six-cylinder Sturtevant, is mounted well up in the gap between the planes and sufficiently far back for the propeller to clear the upper plane without any of it being cut away. There is, however, a space of about eighteen inches between the two wings which compose the upper plane. A novel feature of this machine is a thin keel projecting down two feet below the bottom of the boat and acting as a centerboard to steady it when running on the surface of the water.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

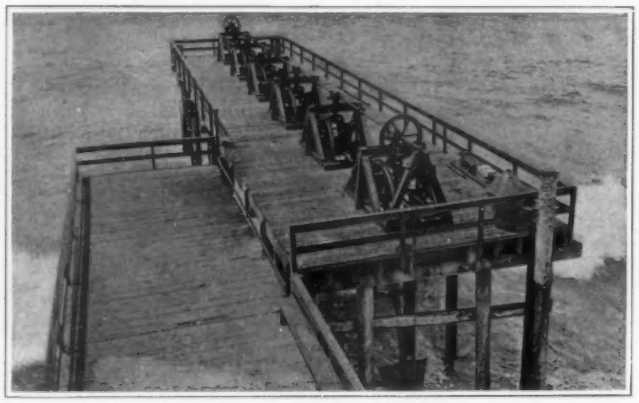
Wave Motors on the Pacific Coast

By L. McCully Edholm

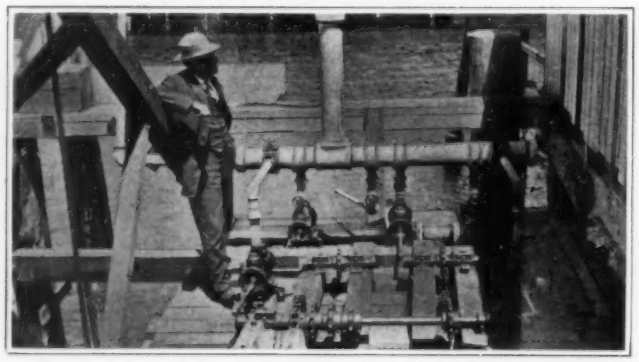
THE sight of the ocean uselessly expending its energy on the sands of the shore has started many a man to puzzling over a way to capture this power and put it to use. Just now a number of wave motors are being tried out at various points along the Pacific coast and some of them are of unusual construction.

One of these motors has been installed at Venice, California, and pumps the sea water to a height of forty feet. To generate electricity it is planned to pump this water into a storage tank, allowing it to run through the turbines. A wooden frame is built out from the pier about twenty feet above the water and this supports the motor, which consists of a large wooden wheel ten feet in diameter mounted on a steel shaft. Two heavy timbers extend from the wheel to two feet below the surface of the water, where they connect with a wooden plane placed to receive the full force of the waves. The incoming breakers dash against the plane driving it shoreward, while the receding waves force it violently out again. This motion oscillates the wheel and the power is transmitted to four pumps by means of steel wire cables. The sea water is pumped to a height of forty feet through a three-inch pipe. As the tanks have not yet been placed to receive the water, the spray can be seen in one of the accompanying photographs falling in a shower.

The 10-foot wheel rocked by the waves operates a set of pumps.



Wave motor near San Diego that does not employ a pump.



Pumping set driven by the wave motor. Note the spray in the background.

Fully a score of different wave motors are being tried out along the coast. A motor near San Diego works on a somewhat different principle from the one just described, as it is proposed to generate power without the use of a pump. A photograph of this plant is reproduced herewith.

At Huntington Beach a company has recently secured a concession on the municipal wharf on the promise that it will install a wave motor and supply free light to the little town. Hence its development is being watched with much interest.

How to Sell Inventions

By William Atherton Du Puy

OF course the most directly important point in invention is realizing money upon the children of one's brain thus called into being. There is always a secondary sentimental satisfaction in an invention when it becomes an item, large or small, in the progress of the times and contributes its share to the added comfort and well-being of human kind. The inventor is likely to appreciate his service to his fellows and prize this benefit in proportion to its real worth. But if he gets far in invention he must likewise be a practical man and make money out of his labors. This money is, quite naturally, the immediate object of his activities.

Advising the inventor as to the best method of procedure in marketing his patents is rather a difficult task. There are no well known roads to wealth through invention that may be very definitely pointed out. The men who have been successful, however, have a good deal to say on the subject and their advice ought to be of the best. In that they agree as to general principles a good, middle-of-the-road course may be prescribed which, when modified by the exceptions in any given case, ought to get its value out of almost any patent.

The inventor should have thought of the sales end of his creation before he spent much time and energy upon it. An invention intended to add to the convenience of three-legged people might be of great worth to those so constituted but the possible sales would be so few that its development would not be profitable. There are many more two-legged people and it would be better judgment to invent for this larger field. It would be more practical to patent a cotton picker than a daisy picker because there is a bigger industry demanding the former. An improved shoe would have a material advantage over an improved glove for there are more shoes worn than gloves.

The inventor should first ask himself if there is a demand for the thing he proposes to develop. He should attempt to get the viewpoint of the possible purchaser and manufacturer of his invention and judge from that angle whether or not his idea is worth while. He should remember that great numbers of his article must be sold to make its manufacture worth while. He should consider the probable price that the purchaser will be willing to pay for such an article. He should determine whether or not the article can be manufactured with sufficient cheapness that its sales may assure the necessary profits. There may be articles in the market that will compete and this competition must be met. Therefore the inventor should think of the practical problems of the market before he gives much time to a prospective invention.

Upon the completion of his patents, these being of record at the Patent Office, the inventor will receive circulars from half a dozen sources, embodying proposals to market these patents. These circulars will tell of the various methods used by their senders of bringing patents before an industrial world which is waiting on tiptoe for just such inventions. When the patentee answers one of these circulars he will find that a fee in advance is required on one pretext or another. He sends the fee. This is the last he ever hears of the circular senders. I have never talked with an inventor who has ever sold anything through these self-styled benefactors of the ingenious. It would seem that it would be entirely possible to conduct a business of this sort that would be mutually beneficial to the patentee and the manufacturer but as far as I am able to ascertain, no such business exists.

So it is the part of wisdom for the inventor to forego this immediate proffer of possible benefit. He has a better way nearer home. Whoever he is and wherever he live there is, near him, someone who is an authority upon the very sort of thing he has invented. If it is an appliance that has a place in any phase of railroad activity, there are men in the repair shops of the nearest railway division who will be excellent judges of its merits. If it is to be used in the building trades, ask the men who are putting up the business blocks of your home town about it. The local hardware man should be a fair judge of the usefulness of any ordinary tool. It is not likely that you will invent anything with reference to factory machinery unless you live in the atmosphere of a factory town. Then you have your authority to whom to show your models. Whoever you are and wherever you live there are practical people near to whom you may go for advice. You should remember that the advice of only successful people is worth while. Go to the man at the top. If he is interested something may be accomplished, while the enthusiasm of the unimportant man availeth nothing.

Criticism, condemnation, ridicule of your invention may not justify its abandonment. Many of the greatest inventions have been ridiculed in the beginning. Make the critics show you why your invention is no good. If you are an intelligent man and they cannot show you why, keep up your confidence and your efforts. This criticism will breed new ideas and improvements.

Finally, if your idea is any good, it will come through this fire of criticism. In the meantime it may have attracted backers. The successful men who know most of the sort of industry in which your invention is to be used are the very kind of men who are most likely to finance its manufacture. They understand its usefulness and its possible market. They are successful people and therefore are likely to have money with which an enterprise that promises great profits may be put on its feet. They have financial friends who have confidence in their judgment.

If you have selected important people in your canvass, people who know your line, you will not have gone far before you will have interested someone who may help you. Probably some two or three men may be brought together to start the manufacture of your device. You furnish the patent and they furnish the money. You should be ready to make favorable terms with such people. You may have a patent that is worth a million dollars. You are entirely justified in giving away to the right man one-half of that patent, or a $500,000 value. It is good business on your part to do this if you select the right man as the beneficiary. This course should lead to the manufacture of the article. The right man being interested in the patent may bring it and you into touch with just the right people to make the biggest thing possible out of your invention.

Your invention may be of such a nature that its sale may not be practicable in this way. It may be merely an attachment to a complicated machine and not a complete article in itself. It might be, for instance, an attachment to a typewriter. This attachment by itself might not lend itself to independent manufacture. It might be of use only to the big manufacturers of typewriters. The managers of the local typewriter agencies should be able to appraise its value to a certain extent. The general agents of your State are bigger men and their opinions would be of still greater

value. If they are sufficiently interested they may bring the matter to the attention of the factory or they may give you letters to their central manufacturing plant that will get you a hearing.

If your patent is not a thing complete in itself you should get in touch with the manufacturers who make the things of which it is a part. It should not be difficult to get the addresses of great numbers of the manufacturers of any given article. The agents for those articles in your home town can give them to you. If you have received sufficient encouragement and have your patent sufficiently developed to thoroughly demonstrate it, you may find it worth your while to make a trip to the factories that offer possible sales and personally interview the party who is the authority on this particular matter.

If your invention is worth while and you present it to the people who are interested in its class and there are no trade reasons why it should not be adopted, you are sure of a sale and should have no great difficulty in making it. There was a time when new inventions were a drug on the market, but that time has passed. The present are the gala days of the inventor. Never before has the world known such activity in the development of new things mechanical as at present. It is an age of frenzied activities that tend always to devising new appliances to save the labor of man and new comforts and conveniences to surround him in his ever increasing field of activity. It is the inventor upon whom devolves the responsibility of supplying these, as it has been the inventor who has so largely been responsible for developing activity. The inventor has created a very complicated surrounding for modern life and modern life has, in return, offered an unlimited field for the activities of the sort of men who created it.

Notes for Inventors

The Number of Pending Patent Applications.—Apart from the pending applications in the Patent Office under rejection and awaiting amendment or other appropriate action, it is interesting to notice that at the close of business on May 3rd, 1913, the total number of applications in the Patent Office and awaiting official action was 27,332.

Two Great Inventors.—In a magazine article published a few years ago, Thomas A. Edison is reported to have expressed the belief that "inventiveness" can be taught if the pupil has ambition, energy and imagination. Recently, Dr. Alexander Graham Bell in a public address on the evolution of the telephone, told how his father encouraged his sons to invent and particularly how he, Dr. Bell, before reaching the age of sixteen, had made some important discoveries in sound which, however, he found were not original but had been described by Helmholtz; also how he and his brother had completed a talking machine which would pronounce the word "mama" so plainly that when operated in the hall of the apartment house caused some of the tenants to open their doors to find out whose child was crying. Dr. Graham Bell told of many interesting experiences leading up to the telephone production and repeated his frequent assertion as to the important part played by his familiarity with the science of sound, telling how the sound and electrical features of the telephone inspired some one, Maxwell, probably, to describe the great invention as the result of a cross-fertilization of the sciences.

Combined Pocketbook and Powder Puff.—The patent, No. 1,049,184, to Anton Widrich of New York city, for a pocketbook and powder puff, will be interesting to the ladies as involving a modification of the popular vanity box. In his patent Mr. Widrich provides a purse-like portion on one side for holding small change or the like and an oppositely located similar portion within which is formed the powder puff, the whole presenting the appearance of a double or two-sided pocketbook, the purse portion when closed serving as a handle for the powder puff portion when the latter is opened.

A Clock that Needs No Winding.—Two Austrian watchmakers have built a clock which receives its motive power from a current of air blowing upon a turbine-shaped wheel. The clock is so simply built, that the current of air produced by a stove or kitchen range is sufficient to make it go. The air is brought to the clock by a pipe fixed upon the wall. A very strong current is reduced by a certain clever contrivance which regulates the speed of the works. This clock serves at the same time as a ventilator. The one built as a sample is installed in a restaurant at Unymarkt and works satisfactorily.

A Number of Metal Culvert Patents.—Patents Nos. 1,049,542, 1,049,543 and 1,049,544 have been issued to the Smith Metal Perforating Company of San Mateo, Cal., as assignee of Andrew Smith of the same place. The patent, No. 1,049,542, has its sections provided at their meeting ends with integral reinforced terminal portions so formed as to constitute abutments to resist longitudinal stresses; the patent, No. 1,049,543, comprises longitudinal segmental sections provided with outstanding flanged edges with the metal doubled back upon itself and extending into its section and having a brace flange lying against the inner wall of its section, while the patent, No. 1,049,544, forms the sections with sheet metal casings having outer corrugated sections and an inner smooth walled metal lining.

How to Straighten Curly Hair.—Hair straightening preparations are somewhat popular in section inhabited by the kinky haired. We find John Wesley Freeman of Alleene, Ark., has secured a patent, No. 1,055,972, for a method of treating kinky human hair which consists in applying to the hair a normally solid oleaginous dressing and then combing the hair with a heated comb to cause the hairs to be straightened and separated and individually coated with the dressing.

Preserving Green Vegetables by Cool Water.—In patent, No. 1,055,353, to Clarence H. Plummer of Black River Falls, Wis., is presented a process of temporarily preserving green vegetables such as peas and beans in which the vegetables are subjected to an upwardly flowing stream of cold water for a sufficient period to reduce their temperature approximately to that of the water.

Cigar-bunching Machine.—The International Cigar Machinery Company of New York city, as assignee of S. I. Prescott, has patented, No. 1,051,005, a cigar machine, which includes in connection with means for shaping a selected number of outspread leaves to produce a Spanish bunch, means which act on the shaped leaves to form a bunch and also means which act on the formed bunch to convert it into a cigar, the invention being characterized by the selection means in connection with the others specified.

A Poppet Valve of High-speed Steel.—A patent, No. 1,051,845, has been issued to the Rich Tool Company of Chicago, Ill., assignee of George R. Rich of Oak Park, Ill., for a poppet valve, which is constructed of high-speed steel or a steel containing in its composition a percentage of tungsten. It is claimed in the patent that poppet valves of high-speed steel are capable of holding the temper when subjected to very high temperatures and remain in perfect working condition and free from any appreciable carbon deposit after having been subjected to high temperature of gases in an internal combustion engine of an automobile during a run of 4,000 miles.

Two Musical Instruments Combined.—Andreas Radovanovic of Zürich, Switzerland, has secured a patent for a harmonium which has attachments for transmitting the pressure of its keys to those of a piano keyboard so that when the parts are properly coupled up and in close proximity, both instruments may be played simultaneously by actuating the keys of the harmonium.

Life-saving Device for Vessels.—In a patent, No. 1,051,649, issued to Howard Thurston of Coscob, Conn., which has now been assigned to the Government of the United States of America, there is provided life-raft construction which operate to form a part of the deck or decks of the ship in such manner that large portions may be readily detached and launched overboard in case of accident when the ship is sinking or is in danger of sinking.

A Novel Alaskan Sled.—Daniel E. Riley and Carrie Davis Powell of Nome, Alaska, have patented, No. 1,053,876, a sled which has a body and front and rear bob-runners pivotally connected with the body and having an engine mounted on the front end of the body and an aerial propeller at the rear end of the body with its shaft extended diagonally of the body and arranged to be actuated by the engine.

A Series of Chain-pipe Vise Patents.—In patents, No. 1,054,661 to 1,054,665 inclusive, are shown a number chain-pipe vises all of which are characterized by the provision of a chain to partially encircle the pipe and a jaw block recessed to engage the pipe together with means for adjusting the jaw to clamp the pipe within the chain. The patents issued to J. H. Williams & Co. of Brooklyn, N. Y., a corporation, on the applications of George Amborn of Chapinville, Conn.

Anti-skidding Device for Automobiles.—To prevent an automobile from skidding, it is the custom to provide the wheels with tire chains. The task of applying the chains is a laborious one and takes considerable time. In order to provide a simpler method of preventing tires from skidding, an inventor has devised rollers equipped with several short lengths of chain. These rollers are mounted adjacent to the rear wheels of the automobile and may be brought into engagement with them whenever desired. Owing to frictional contact with the wheels the rollers will be revolved rapidly while the vehicle is in motion and the chains will be thrown out centrifugally, bringing them under the tread of the wheels and thus preventing the wheels from skidding. Whenever it is desired to remove the anti-skidding device, it is merely necessary to operate a lever which withdraws the rollers from engagement with the wheels and the chains from under the tread. Patent No. 1,045,609 has been granted on this device.

Chauffeurs' Signaling Glove.—It is the custom of drivers of automobiles, particularly in cities, to signal with the hand when they are going to make a turn to the right or to the left or when they are about to stop the car, for the benefit of following automobiles. To provide a more effective signal and particularly one which can be used at night, a new signaling glove has been invented. (Patent No. 1,046,225). This glove carried a battery strapped to the wrist portion, also an electric bell above the battery and an electric lamp on the back of the hand portion. The circuit of the bell may be closed by touching a thumb contact with a contact on the first finger of the glove, while the circuit of the electric lamp may be closed by touching the thumb contact with another contact on the first finger of the glove. In this way the chauffeur may give either an audible or a visible signal.

Multiple Telescope.—An inventor has devised an astronomical instrument consisting of three telescopes so adjusted to one another that their fields of view are coincident. They are mounted on a common stand and the movement of one will cause the movement of the entire series. The object of this triple telescope is to facilitate the instruction of students. The instructor is stationed at the central or pilot telescope and he keeps the object in view, that is in the field of all three, so that the beginners need not be concerned with the training of their telescope, but can devote their entire attention of the study of the object in the field. Thus, instruction is made coincident with observation. The instructor, by taking two students at a time, can give his class longer sessions at the telescope. He can also instruct the student at either side in the difficult operation of keeping the object directly in the center of the field of observation.

Legal Notes

The Senate Patent Committee.—The patent committee for the Senate of the 63rd Congress is composed of Ollie M. James of Kentucky; Benjamin F. Shively of Indiana; Ellison D. Smith of South Carolina; Thomas P. Gore of Oklahoma; Frank B. Brandegee of Connecticut; William S. Kenyon of Iowa, and LeBaron B. Colt of Rhode Island. Of these, it will be noticed, only two members are from New England.

Presumption from Refusal to Answer.—The Court of Appeals of the District of Columbia, speaking by Mr. Justice Robb in the case of Perri v. Thoma, held that where, during the taking of testimony, an inventor testified to the finding of a book containing a memorandum which he stated enabled him to fix dates of invention prior to those previously set up, and such memorandum might apply to any one of several inventions for which applications have been filed, and the inventor refused to state at what time each of said inventions was made, his testimony had no probative force. The refusal to answer warranted the presumption that another application than the one in interference might have been filed and to which the memorandum referred. The witness was asked in cross examination at what time he made each of his five applications and was instructed to confine his answer to such applications as had been patented or as were involved in the interference in question.

Some Adjudicated Patents.—In the case of Johns-Pratt Company v. E. H. Freeman Electric Company, 201 Fed. Rep., the Sachs patent, No. 660,341, for a safety fuse was held valid and infringed. The Painter patent, No. 792,284, for a method of making bottle stoppers or closures, was held valid and infringed in Crown Cork and Seal Company v. Brooklyn Bottle Stopper Company. The Painter patent, No. 887,838, for bottle stoppers was held valid and infringed in Crown Cork and Seal Company v. Brooklyn Bottle Stopper Company. The Wheeler patent, No. 887,883, for bottle stoppers was held valid and infringed in Crown Cork and Seal Company v. Brooklyn Bottle Stopper Company. The Lafean patent, No. 945,788, for an improvement in caramel holders was held valid and infringed in American Caramel Company v. Glenrock Stamping Company. The Lafean patent, No. 945,788, was held valid and infringed in American Caramel v. Williams. The Roland reissue patent, No. 12,933 (original No. 907,407), for a subaqueous rock breaker held valid and infringed in Submarine Rock Breaking Company v. Submarine Company. The Moore patent, No. 764,486, for a filtering process was held valid and infringed in Moore Filter Company v. Tonopah-Belmont Development Company. It will be noticed that in all of the above cases the patents were held valid and infringed.

Other adjudicated cases include the Ransome patent, No. 694,580, for a reinforced concrete floor in which claims 5 to 10 inclusive were held not infringed in the case of Ransome Concrete Company v. German American Button Company. The Cardwell patent, No. 940,853, for a wallet, which was held void for lack of invention and also held not infringed, is conceded validity in Cardwell v. E. J. Wilkins Company, and the Muller patent, No. 1,035,098, for mechanism for producing a walking motion in toy figures, held on a motion for preliminary injunction void for lack of invention in Nurnberger Metall. etc. v. New X Toy Manufacturing Company.

Jurisdiction of Federal Court.—In the case The Fair v. Kohler Die and Specialty Company, the Supreme Court, speaking by Mr. Justice Holmes, has held that where the plaintiff relies upon infringement of his patent and nothing else, the cause whether good or bad is one arising under the patent laws of the United States and the Federal Court has jurisdiction. In this case the defendant pleading to plaintiff's bill for infringement of a patent by selling the patented device below a specific price, denied that there was any infringement of the patent and alleged that the cause was not one arising under the patent law.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

DRESS SHIELD POCKET.—M. BARROW, care of Barrow Mfg. Co., 119 Wooster St., New York, N. Y. This shield is more especially for use on washable garments, such as corset covers and the like, and it permits the convenient inserting of a dress shield and retaining it correctly in place therein, and allows of removing the shield from the pocket immediately prior to washing the garment, thus preventing injury to the shield while the garment is being washed.

ELASTIC FOR CHILDREN'S SOCKS.—ELEANOR M. HATFIELD, 838 Bedford Ave., Brooklyn, N. Y. This invention provides means for retaining stockings, socks, gloves or similar articles in proper position. An object is to provide an elastic which is adjustable to suit the individual wearer of the garment, and when so adjusted to be capable of being locked or set so that no other adjustment will be necessary.

SHIELD FOR CHILDREN'S BLOUSES.—S. BERNSTEIN and C. BERNSTEIN, 215 Greene St., New York, N. Y. The principal object in view in this case is to provide a shield formed of two sections, by the successive removal of which the throat of the wearer may be exposed to different degrees. By varying the design and color of either section a varied and pleasing effect may be imparted to the blouse at a nominal cost.

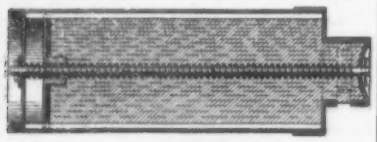
Of Interest to Farmers.

COTTON CHOPPER AND CULTIVATOR.—R. HAMILTON, P. O. Box 711, Pensacola, Fla. In the present patent the invention has reference to combined cotton choppers and cultivators, and has for its principal object the provision of improved means for controlling cutting disks carried by the machine.

WEED CUTTING MACHINE.—E. O. MARSHALL, 905 E. Alder St., Walla Walla, Wash. This machine is especially adapted for clearing summer fallow ground of weeds, preparatory to seeding, wherein the cutting means moves beneath the surface of the ground, and may be adjusted vertically in accordance with the depth at which it is desired to cut the weeds.

Of General Interest.

CONTAINER.—J. A. BOOS, 101 Beekman St., New York, N. Y. This invention relates to receptacles for containing and discharging semi-solid, adhesive or pasty substances, such as greases, vaseline, rubber cement, shaving creams, tooth pastes, etc., and for butter in hot climates; and provides a container of any size or shape, arranged to be kept normally hermetically sealed when not in use to prevent the substance from drying and hardening, and when in use to discharge the contents in the form of ribbon or stream. It is provided with a discharge opening to alternately open and close the same at each revolution of the valve, a plunger for moving the contents of the receptacle toward said opening and a screw rod screwing in the plunger and centrally attached to the valve to rotate with the latter. Superior to collapsible tubes and cheaper, being easily filled and holds its shape.



CONTAINER.

DOUBLE DRAINAGE AND VENT FITTING.—C. S. C. ROCK, 204 W. 140th St., New York, N. Y. The invention provides a double drainage and vent fitting arranged to provide a plurality of waste connections and a double vent, at the same time permitting convenient turning of the fitting to extend the waste inlets into the desired direction for connection with the waste pipes of the fixtures.

PROCESS OF PHOTOGRAPHY IN COLORS.—A. J. B. TAULSIGNE, Pontigny, Yonne, and E. MAZO, 8 Boulevard de Magenta, Paris, France. This invention enables photographic positives to be obtained in all shades, by the transformation of an ordinary silver positive into an aniline monochrome. The process can be employed for: obtaining simple positives in all shades on glass or paper; obtaining superposed bi-colored double prints for projection in relief; obtaining trichrome positive for color photography.

PROCESS FOR PRODUCING A PRODUCT FOR ATTRACTING INSECTS.—G. MAIRE, 108 Rue du Prince Abdel-Moneim, Alexandria, Egypt. This invention has for its purpose a process for producing a product emitting odoriferous effluvia capable of attracting certain insects from a great distance to a trap serving to catch them, such as the trap for example which formed the object of patent application serial No. 584,329.

MOLD FOR MOLDING CONCRETE.—G. W. HERING, P. O. New Rochelle, Dean Place, Larchmont, N. Y. This mold has collapsible cores, whereby a concrete or cement shell may be formed and the core and mold removed without disturbing the shell. The core is connected to the mold, so that the movement of the latter will actuate the former to move the parts thereof out of contact with the shell or core formed.

MEASURING WEIR.—C. W. CHEATHAM, Hamilton, Mont. The intention in this instance is to provide a simple, inexpensive, easily set up and operated device by means of which the amount of water to be delivered may be accurately controlled, regardless of fluctuations in the amount of water in the main canal.

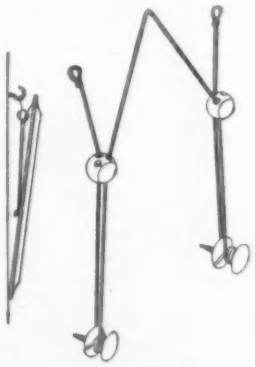
MOORING DEVICE FOR SUBMARINE MINES.—G. E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France. This device enables submarine mines to be raised independently of their mooring anchor and the device is intended more particularly for rendering the connection between the mine and its anchor detachable in such a manner that these two members can be recovered individually so as to avoid possibility of accident.

Hardware and Tools.

LIQUID LEVEL.—J. L. RUSSELL, Albion, Cal. The invention provides a finder for a level wherein is employed an air bubble, the finder providing a traveling surface for the bubble semi-circular in form; provides a graduated scale disposed adjacent the path of the spot of the finder and a movable index for the scale to indicate the position of the spot previously attained or to be attained; and provides means for increasing or diminishing the size or definition of the spot.

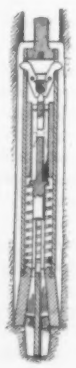
VISE.—J. T. CARTER, care of R. P. Reese, Pensacola, Fla. The invention relates more particularly to a vise used by harness makers and leather workers, the object being to provide a construction whereby clamping members of different types and materials may be interchangeably associated with the jaws of the vise, and in this way adapt the vise to the use of the numerous other workers in wood, metal and other materials.

CLAMPING DEVICE.—J. HUBER, 220 N. 4th St., Saginaw, Mich. The object here is to provide a device for use with ordinary picture wire or any other flexible member for hanging pictures or other articles from moldings or other supports which permits the effective length of the wire to be adjusted as necessary, which further permits the angularity with which the picture rests against the wall or other support upon which it is to be hung to be varied as desired, which can be manipulated with ease and rapidity, and which will not mar or injure the wall or picture.



CLAMPING DEVICE.

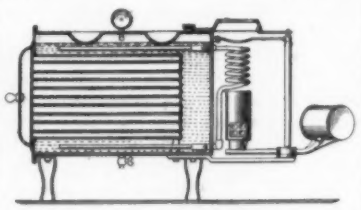
REAMER.—J. LORENZ, Robinson, Ill. This tool is especially adapted for under reaming, wherein the parts may be contracted to permit the passage of the tool through the well casing, which will automatically expand into working condition when the proper position is reached and wherein a safety device is provided for preventing the accidental displacement of the parts.



REAMER.

Heating and Lighting.

WATER JACKETED STOVE.—M. KELLY, care of G. Taylor, 17 South St., New York, N. Y. In this invention the object is to construct a combined stove, one part of which is an ordinary gas or oil stove designed to heat a water-jacketed oven to a definite temperature, thermostatic means being provided for removing the heater to an inoperative position relative to the water in the jacket, so as to maintain the oven at a constant temperature.



WATER JACKETED STOVE.

ACETYLENE GAS APPARATUS.—M. E. LOEHR, Claypool, Ind. This improvement provides means for agitating the carbid to obtain the full gas production thereof; and provides a generator and apparatus connected therewith to prevent the lodgment or accumulation of sludge therein.

AUTOMATIC CUT-OFF FOR GAS BURNERS.—R. HUGHES, 210 So. 3rd St., Mount Vernon, N. Y. This invention relates to cut-offs for gas burners and has for an object to provide a structure in which the supply of gas will be automatically cut off to a limited extent, so as to reduce the size of the flame when the burner is not in use.

Machines and Mechanical Devices.

GEARING.—ERNST W. F. HERRMAN, 1200 Hays St., San Antonio, Tex. The object of this invention is to couple up at will two independent drive shafts with two independent engines, so as to connect either engine with either shaft, both engines with either shaft, or both engines with both shafts. The invention has special reference to a flying machine, in which there is a front and a rear propeller, and the device may be of general application for use wherever a drive of this character is desired.

TYPEWRITER HOLDER.—L. C. FOX, Stevenson, Wash. This invention pertains to adjustable supports or brackets, and has particular reference to a device adapted for supporting a typewriting machine upon a table or desk so that it may be swung around or housed out of the way when not in use.

JACQUARD LINK FOR KNITTING MACHINES.—G. C. L. TISCH, L. TISCH, JR., and J. H. TISCH, 348 Livingston St., Elizabethport, N. J. This invention relates to improvements in jacquard links, and the purpose is to provide an improved construction of link to that shown in Patent No. 457,265, so as to overcome the more or less loose motion which results from wear.

PROCESS OF PREVENTING MOLDING IN SHAPED TIMBER.—F. M. KENNEDY, Clarendon, Ark. An object here is to extract hot sap from steamed timber by passing a piece of steaming hot timber between two revolving rollers of the machine. In the operation the wood passed is prevented from becoming moldy while it is being dried.

SAFETY DEVICE FOR OPERATING SUBMARINE MINES.—G. E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France. The invention has for its object a device for the firing arm of submarine mines or torpedoes and serves more particularly to render this arm or lever insensitive to the force of the sea currents or to the explosion of adjacent mines by preventing it from shifting under the influence of friction or shock of the hull of a vessel.

AUTOMATIC SUBMARINE MINE.—G. E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France. An automatic submarine mine has been described in which the ignition cartridge is integral with the guide cylinder of the striker, which renders it necessary to dismount the whole of the percussion system in order to inspect or charge the ignition cartridge.

DYEING MACHINE.—C. P. DELAHUNTY, care of Delahunty Dyeing Machine Co., Pittston, Pa. This improvement refers more particularly to a means for pumping the dyeing substances through the vat. A further object is to feed the dyeing and washing agents from the bottom of the vat through the materials that are to be dyed.

Prime Movers and Their Accessories.

MUFFLER.—A. N. RUSSELL and I. G. MASON, care of Ticonderoga Machine Works, Ticonderoga, N. Y. The intention here is to provide a muffler to be used in internal combustion engines, with a plurality of disks, spaced apart, with central openings and corrugations extending therearound, so that when the gases of combustion are directed between the disks by the members disposed in the openings, the expansion of the gases is retarded and the direction of flow of the gases is reversed at each corrugation, by which means the explosive energy is absorbed.

Railways and Their Accessories.

COMPENSATING TRUCK FOR RAILWAY CARS.—A. J. KELLOGG, Newberg, Ore. The intention here is to compensate for, or reduce to a minimum, the torsional strain to which the axles and bearings are subject, and to obviate invariable frictional and shearing actions of wheels and their flanges upon rails of curves in a line railroad, which occur through conditions wherein the outer wheels of a truck have a circle of a larger arc to traverse than that of wheels on the inner and consequently shorter circle, with the resultant slipping and grinding of the latter, and similar heavy friction and tendency to shear of the former.

CAR FENDER.—J. P. GERAGHTY, 50 W. Hamilton Pl., Jersey City, and G. W. NAYLOR, 53 Bayview Ave., Jersey City, N. J. For carrying out the purpose of this invention use is made of an apron frame mounted to turn and to slide on a support and connected with upwardly extending links for normally holding the frame in approximately horizontal position. The frame, on being moved rearward, causes the links to swing downward into receiving position.

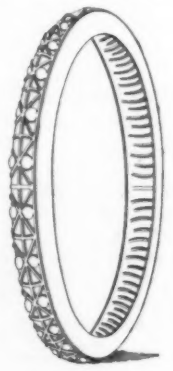
Pertaining to Recreation.

PIVOTAL SUPPORT.—S. W. BRUNDAGE, care of C. W. Parker, Leavenworth, Kan. The principal object of the invention is to provide a support for use in a variety of different mechanisms, being particularly designed, however, to provide a pivotal mounting which may be easily and quickly dismantled. It is especially adapted for use on carousels or merry-go-rounds.

CAROUSEL.—H. L. MILLER, care of C. W. Parker, Leavenworth, Kan. This invention relates generally to carousels, and is more particularly directed to a structure wherein the oscillating movement imparted to the figures is brought about through the medium of the overhead construction which carries such figures.

Pertaining to Vehicles.

TIRE.—MARY DAWSON, 417 Campbell Ave., Vancouver, British Columbia, Canada. The invention pertains to means for preventing puncture of the inner tube of a tire, and it is a design of the improvement to provide spaced interior elements on the outer shoe, or otherwise so arranged to contact with the exterior surface of the inner tube in such a manner as to reduce the contact surface of the inner tube with the adjacent surface of the shoe or adjacent tire elements, whereby the inner tube will be less likely to be punctured.



TIRE.

Designs.

DESIGN FOR A STREET LIGHT STANDARD.—J. MCL. PETTYJOHN, 601 N. 6th St., Terre Haute, Ind. In this ornamental design the column is supported by a small square base and its top is capped with four arms from each of which hangs a light globe. The fifth and largest globe is poised upright on the center of the arms.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 9298. Wanted the names and addresses of concerns who can turn irregular shaped handles in wood, similar to gun-stock work.

Inquiry No. 9299. Wanted name and address of the maker of a machine for driving fence posts into the ground.

Inquiry No. 9300. Wanted the name and address of a maker of a patented keyless door lock.

Inquiry No. 9301. Wanted the names and addresses of a few concerns who can do machine embroidery according to the design furnished, at reasonable rates.

Inquiry No. 9302. Wanted the address of the manufacturer of the Greenfield flexible armored conductors or cables. This is a double galvanized, spiral conductor or cable.

Inquiry No. 9303. Wanted the name of manufacturer who could make newly patented articles made from 13 to 22 gage sheet aluminum.

Inquiry No. 9304. Wanted the names and addresses of manufacturers of a second hand bag cleaning machine on the order of a carpet cleaning machine

Inquiry No. 9305. Wanted the name and address of concerns making paper letters and figures.

Inquiry No. 9306. Wanted small hardware and other specialties to be sold in notion and grocery stores. Wanted to buy wholesale

Inquiry No. 9307. Wanted to buy a machine for honing and stropping safety razor blades on a commercial scale.

Inquiry No. 9308. Wanted woven glass fabric for manufacturing purposes in large quantities. The glass is spun.

Inquiry No. 9309. Wanted to buy small woven tubing of small diameter for use over the temples of spectacles where they go around the ears.

Inquiry No. 9310. Wanted addresses of manufacturers of good selling articles for mail order business catering to the trade of agents.

Inquiry No. 9311. Wanted names and addresses of manufacturers of hatpin heads made of colored glass; also medals of all shapes.

Inquiry No. 9312. Wanted to buy a machine which will pick up a weight the size of a lima bean by vacuum process. Must be able to pick up dust, gravel, etc. Must be operated by electricity and be easily portable.

Inquiry No. 9313. Wanted to buy Leather Held Horse Shoes used temporarily when shoe cannot be nailed on. In other words a Leather Boot with iron shoe at bottom—strapped over horse's foot.

Agriculture, Electricity and Irrigation

(Concluded from page 472.)

except that both supply and demand for the current have increased.

Some of the farms in the vicinity of Visalia, Cal., are typical of the conditions suggested. The majority are small truck and fruit farms ranging from 10 to 40 (an average of about 20) acres to each person. These farms may be termed electrically irrigated farms, for in practically all cases the farmers operate irrigation pumps by electricity, and the details of this class of electrical supply are well established.

In the State of Washington, we find similar interesting conditions where there is electric service for power and lighting use in all the newly settled farming districts.

We should study closely, all that has been projected in these great, electrically operated irrigation farms of America, for surely there can be no more important work for us in this day of agricultural investigation, than to apply in all sections of our country the principle of efficiency which underlies the utilization of our resources, exemplified by these illustrations.

During the primitive period of the history of American farming there was too much extensive husbandry and not enough intensive farming. Land was abundant and cheap, and much of it drained itself. The pioneer, believing the supply of land inexhaustible, selected a patch, killed off the trees, cultivated it until available plant life in the soil was exhausted, and then moved to another field. In this way, the increase in population being rapid, great inroads were made on the country's natural soil resources. In time, all the naturally drained and naturally watered lands were utilized, and a great portion exhausted, temporarily at least, and the reclamation of our western semi-arid and prairie land, along scientific lines, should be an object lesson to us all. Those lands are now rapidly being taken up and have become valuable. Additional, fertile, low cost farms, by the tens of thousands, are needed more and more as our population doubles.

We have learned from these western developments that for proper crop culture, all lands should be drained and all crops need water. And it is not sufficient to have water by the deluge—from time to time—but water must be applied in such manner as to provide the stimulant necessary to plant life, in order that development may be greatest at certain stages of growth. This is especially interesting, in that it is a claim for the merits of irrigation, not only in the arid country, but in sections where there may be an abundant rainfall.

So it is seen that scientific agriculture, irrigation and electricity have formed a powerful combination. The natural waters are played with at will, sometimes passing directly to the land, but more often the turbulent mountain streams are carried for miles in flumes or canals, only to give up energy at several points on the way, and ultimately to irrigate the land by gravity, or pumping, as the conditions may require.

Another method is to drain the marsh land and pump the water thus available to the higher places adjoining. Suitable crops are then grown on land of any level, with the result that the area for production is materially increased.

Irrigation is the key which rejuvenates, as well as unlocks the fertility of the soil, and to comprehend its importance in agriculture, one must appreciate the fundamental principles governing plant growth and soil culture.

When we consider that all plant life must have moisture, and at certain stages of growth more water is required than at other times, it will be seen that to be able to control the supply of moisture places the growing of crops largely under the control of man. That is to say, we are thus able to aid the plant growth in a way that Nature does not do always.

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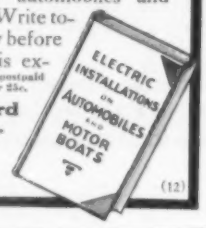

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Rain may or may not come when it is needed most, and again, it may pour down in destructive quantities, but water under a well-managed irrigation system is turned on when and where and to the amount desired. This makes farming in semi-arid regions a more definite and scientific proposition than it is in parts of the country apparently more favored by Nature. And through the recognition of this fact, we are able to learn a lesson that holds good for all sections, namely, that when we have so arranged our soil conditions that water may be drained off the land as positively as it is applied, the application of irrigation methods is beneficial, no matter what may be the natural conditions of rainfall.

Pump irrigation means intensive farming. And this is the direction in which our eastern States' agriculture is moving. It may also be added that the power required for pumping has proven to be the opening wedge in introducing the use of electricity in the majority of those farming districts where dependence upon this form of energy has become established. The most scientific farming can be done only by electric pump irrigation, where the work can be programmed and the farm run just as systematically as some of our big manufacturing and commercial undertakings.

Many an eastern farmer can recall that he has watched the clouds float by, while wishing that rain might fall. The few irrigation equipments that have been experimented with in our humid sections prove conclusively that such anxiety may hereafter be avoided.

During the spring of 1911, the early strawberry crop of many eastern sections was completely destroyed by a six weeks' drought. Four acres of strawberries irrigated under an experimental plant in New Jersey, yielded the land owner between $400 and $500 per acre. The season's yield of New Jersey alfalfa was increased by irrigation at the rate of two tons of cured hay per acre, worth $25 per ton. Four acres of five-year-old peach trees responded to irrigation with $3,400 worth of fruit.

These results, according to the Government engineer, under whose direction the experiments were conducted, were obtained on a farm which has been cultivated for 250 years, on lands which have heretofore failed to yield sufficient returns to keep one boy out of ten on the farm, lands which heretofore have failed to yield sufficient returns to encourage the clearing up of thousands of acres of similar lands. Similar lands lie here at the very door of European immigration, untouched by the plow, within a few miles of 10,000,000 consumers, land which should be reclaimed and made the garden plot of this great multitude.

When we awaken to the large areas of dormant, latent agricultural possibilities that will come about through drainage of the low lands, coupled with a general practice of irrigation throughout our South and our East, much in the same way that water distribution has been conquered in our West, we will realize that here are many millions of acres to be added to the productive area of this country.

These are problems requiring immense work and study for years to come, but the beneficial results will outweigh many times the cost and labor that will be necessary to solve the problems. At present, an abnormal condition exists just as it did in the semi-arid sections before irrigation was introduced, and it is my belief that the reclamation of worn-out farms and barren lands of the Atlantic Slope now presents most remarkable agricultural opportunities.

Franklin Institute Treasures

(*Concluded from page 473.*)

principle and leaky and was ultimately abandoned. The model at the Franklin Institute is a working model, complete in every detail.

Brush's original arc lamp is given a place of honor in the collection. It is a very heavy contrivance, but in principle it differs little from the improved lamp of the present day.

There is a fine collection of water wheels in the exhibit, showing the early idea of the steam turbine of the present day. In the collection are overshot, undershot and breast wheels, including Parker's original percussion and reaction water wheels. The original testing machine made for the committee appointed to investigate the strength of materials can be seen at the Institute, several good architectural models showing buildings and bridges and the efforts made by past generations of engineers to overcome natural obstacles. Elihu Thomson's original electric welding device, demonstrated for the first time at the Franklin Institute in 1888, is on view, and also Outerbridge's process of giving iron a lace-like pattern from the use of lace itself, an odd method of ornamentation that is not the method in use to-day.

For those interested in the resisting capacity of the barrels of guns there is a varied assortment of burst barrels, showing how far a barrel can be driven without giving way. Tests were made by stopping the barrel of a rifle with clay, with sand, with mud and various other substances, and gaping holes in the metal show the danger of firing a gun with any obstruction in the barrel. Other exhibits show the strength of rifle barrels made by various nations. The amount of powder was augmented in each discharge until the barrel burst.

A corner that will interest many visitors is that given to the display of various typewriting machines of antique design. Some included in this collection were considered most satisfactory machines by men who are by no means old men to-day, but they are no longer manufactured. They are curiosities even among the collections of the second hand dealers, and some are probably not even to be seen there. The original bar lock typewriter is among them.

Among the odds and ends of curios may be mentioned the pneumatic carrier used when this feature of the postal system was first installed, a machine for barking trees, a Daguerreotype model camera made by Isaquin Bishop in 1839, camera and developing box complete, several models of the early printing telegraph, including Bain's original printing telegraph; a model of Godfrey's quadrant, made by James Ham in 1781; Emmons single track railroad, the original single track road of 1837; ice boats and ice crushers, canal boats with propellers, and a large collection of Franklin relics, including his bench for dressing type and his static machine.

There are nearly three hundred models in the collection, which has been brought from the dirt and obscurity of the Franklin Institute's cellars through the efforts of the secretary, Dr. R. B. Owens, assisted by Mr. Bullock. The models have been cleaned, repaired and classified, and all the working parts put in shape by skilled mechanics, a task requiring tremendous labor and not a little research; for some of the models could not be identified without considerable trouble and searching among the old files and journals of the Institute.

Registration of Patents in the Philippines.—The Philippine legislature has enacted under date of February 10th, 1913, an act which provides that owners of patents which have been issued or may hereafter be issued duly registered in the United States Patent Office under the laws of the United States relating to the grant of patents shall receive in the Philippine Islands the protection accorded them in the United States under said laws and that any infringement of such rights shall subject the person or party guilty of such infringement to the liabilities created and imposed by the laws of the United States relating to such matters, provided that a duly certified copy of all such patents shall be filed with the proper bureau or office of the Philippines, and it also provides that the rights of property in patents and trade-marks secured in the Philippine Islands to persons under the Spanish laws shall be re-

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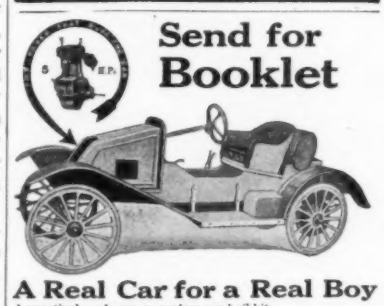

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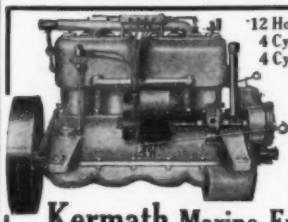

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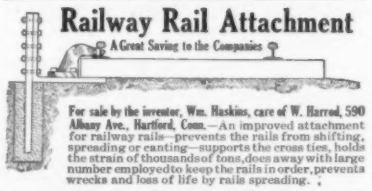
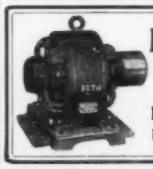


For sale by the inventor, Wm. Haskins, care of W. Harred, 590 Albany Ave., Hartford, Conn.—An improved attachment for railway rails—prevents the rails from shifting, spreading or canting—supports the cross ties, holds the strain of thousands of tons, does away with large number employed to keep the rails in order, prevents wrecks and loss of life by rails spreading.



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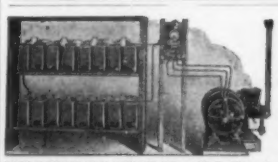

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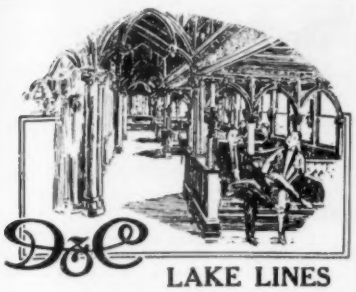

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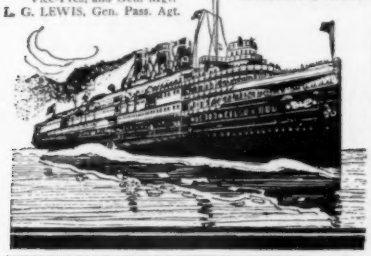

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Rehabilitating the Roman Campagna

A PROBLEM that has baffled the agriculturists of Italy for centuries—the rehabilitation of the Roman Campagna—seems now in a fair way of being solved.

The Campagna is a vast plain surrounding the city of Rome. Its soil is fertile, it is well watered, and the great city at its center offers a market for all that it can produce. Once it was densely populated and prosperous, but to-day it is a desolate wilderness. Not a tenth of its surface is under cultivation; it has no towns, but only a few scattered and ruinous wayside inns and the miserable huts of a handful of herdsmen and vine-dressers. Its deplorable condition is due entirely to the fact that throughout the summer it is a hotbed of malaria. In winter it is habitable, and then many herdsmen drive their cattle hither from the surrounding mountains to graze in the rich pastures; but in the month of May they return to the higher and more healthful land.

Even in ancient times the Campagna was not free from fever, but the presence of a large population kept the disease in check. In the light of modern knowledge this is explained by the fact that the land was kept drained, and there were few neglected places in which mosquitoes could breed. The depopulation of the Campagna was due to the incursions of barbarian hordes, and subsequently to the establishment of great estates in place of the small holdings of earlier times.

In the last half century many attempts have been made by the government and by philanthropists to colonize the Campagna from other parts of Italy, but until recently these undertakings have all failed, entailing immense loss of life. The government went so far as to decree the confiscation of large estates that should be left uncultivated by their proprietors. The latter made every effort not only to attract a peasant population, but to protect settlers from the dreaded scourge. At one time it was believed that the planting of eucalyptus trees would check the malaria, but this expedient, after being tried on a large scale, was found to be of no avail.

Since 1900 the Italian Red Cross Society has maintained stations in the Campagna for the treatment of the fever-stricken people. About the same time the part played by mosquitoes in communicating malaria became known, and the screening of houses was advocated. The government immediately took steps to screen all police stations, military barracks, custom houses, and so forth; the railway companies screened their stations; and the landowners and the peasants themselves followed suit. However, the results of these efforts were disappointing. It was soon recognized that even those persons who took care to keep their window screens in place and their screen-doors closed—as many did not—were bitten by mosquitoes while performing their daily tasks out of doors. The screens enjoyed only a brief popularity and have now been generally abandoned.

Finally, through the efforts of Prof. Celli, director of the Hygienic Institute at the University of Rome, the government turned its attention to quinine. The value of this drug in the treatment of malaria had, of course, long been known, but its cost placed it beyond the reach of the frugal peasantry. The government decided to manufacture its own quinine and sell it at cost price. This step was followed by the passage of laws requiring the local authorities to distribute quinine free to peasants attacked by malaria, and the same obligation was imposed upon public contractors with respect to their laborers. Later the law was given greater scope, and the communes were required to furnish free quinine not only as a remedy, but also as a preventive whenever conditions appeared to warrant such action. The results of these measures are eloquently expressed by the

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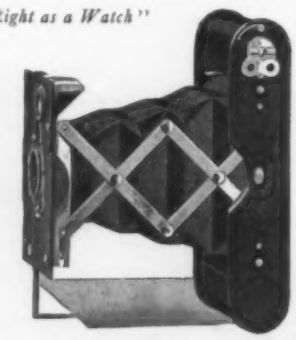

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The Alpenglow

EVERYBODY who has sojourned among the Alps, or other snow-capped mountains, must have admired the gorgeous coloring of the peaks at sunrise and sunset. Watching the splendid spectacle from day to day, the attentive observer soon discovers that it is a complex phenomenon, varying greatly with the weather, and sometimes exhibiting certain peculiarities that, to the uninitiated, are decidedly mysterious.

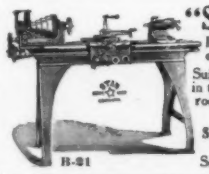
In fine weather the following sequence of events may be noted: When the sun has sunk nearly to the observer's horizon, the peaks to the eastward begin to have a reddish or golden hue. This fades gradually, but in a few minutes, when the sun is a little below the observer's horizon, but the peaks are still bathed in direct sunlight, an intense red glow begins down the slopes and moves upward to the summits. This is identical with the rosy "twilight arch" that in clear weather rises from the eastern horizon as the sun sinks below the western; and it is bordered below by the blue shadow of the earth. Now, for a few minutes, the peaks are in the earth-shadow; their rocks and snows assume a livid appearance, aptly described by the inhabitants of the vale of Chamounix, whence the phenomena in question are well seen on the summits of Mont Blanc, as the "teinte cadavéreuse."

Presently occurs the remarkable phenomenon known as "recoloration" or "afterglow." In Chamounix it is called "the resurrection of Mont Blanc." The peaks, from which all color had faded, again assume a rosy tint; but this time gradually, and without any sharp line of demarcation between the glow and the shadow beneath. The recoloration is by no means a daily occurrence—in fact, it is rather uncommon—and it varies greatly in appearance and duration. Sometimes it lasts until an hour after sunset, and it passes away from below upward. Very rarely a faint second recoloration may be seen. All these phenomena may be seen, in reverse order, at sunrise, though they are less common then than at sunset. They are known, collectively, as the "Alpenglow."

The recoloration of the Alps has been variously explained, but there seems to be little doubt that it is due, at least principally, to the reflection from the peaks of the rosy glow which forms in the western sky after sunset, known as the "purple light," and which is sometimes intense enough to constitute a secondary luminous source. The diffuse appearance of the recoloration, as compared with the well-defined zone of rosy light that rests upon the peaks while the latter are still in direct sunlight, is explained by the broad expanse of the "purple light" as compared with the small disk of the sun. Sometimes the sky itself (i. e., the fine dust in the upper atmosphere) reflects the "purple light," giving rise to a "second purple light" for an observer situated at a suitable angle of vision. This, in turn, may be reflected by the mountains, giving the rare phenomenon of a second recoloration.

A rival explanation of recoloration, proposed by Amsler, according to which the phenomenon is due to a rapid change in the refractive index of the lower air, owing to cooling after sunset, is not now accepted, chiefly for two reasons, viz., it fails to account for the corresponding sequence of phenomena before sunrise, and it assumes stronger contrasts of temperature in the vertical than have generally been found to occur. It is not impossible, however, that the process described by Amsler may sometimes cooperate in producing the Alpenglow at sunset.

health statistics of the Campagna, which show that between 1900 and 1906 the percentage of farm laborers suffering from malaria was reduced from 31 to 3.4. Since 1906 the number of cases has continued to diminish. Already the aspect of the Campagna has changed, and an era of agricultural prosperity seems to be at hand.



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(12805) J. B. asks: Inclosed find ten cents and a few leaflets of an instrument called the ————, and another the ————, which the makers claim to be a wonderful invention. If you have anything describing this instrument in detail, as to how it works and how it is made, send us such descriptive circulars as you may have or tell us where to get them. Should you not have such in stock, send us a SUPPLEMENT on its nature pertaining as near the instrument as you possibly can. Also send us a new catalogue of late SUPPLEMENTS. A. We have recently had several requests of this sort. It is not to be expected that we should have any information upon the instruments such as are described in the circulars which you send us. The basis of all such apparatus is secrecy. The only way one could find out what the instrument contains is to buy one and take it apart, perhaps finding *nothing* in it. We give no indorsement for anything of this sort. The list of diseases named in the circular includes those of the most various origin and cause: several are germ diseases. They cannot possibly all yield to the same treatment. The old family physician who has come in for a generation, and knows the constitution of your whole family for several generations, is the man to prescribe for the family, and will use no nonsense in his work. He will know whether you need any secret apparatus for your cure; that is, he will know that you do not.

(12806) C. A. H. writes: Inclosed you will find a picture of lightning. The picture was taken about two o'clock in the morning, with the shutter of the camera open as for time exposure. You will note the dark streaks in the picture. Will you please explain what caused them? The shutter was left open for perhaps two minutes. A. The appearance of dark lines like lightning flashes upon a photographic plate which has been exposed for a picture of lightning is due to the occurrence of at least two flashes while the shutter was open, one after the other. This is fully explained in an article in the SCIENTIFIC AMERICAN, Vol. 107, No. 9, price ten cents. Your photograph is a good one, but the phenomenon is very common, and every year several such photographs are sent to us.

(12807) W. F. A. asks: 1. Is the speed of sound constant for all pitches? A. The whole subject of the velocity of sound under various conditions is treated in Barton's "Text Book of Sound," price $3.25 postpaid. It is there shown that within the whole range between Ut_1 and Mi_4, the speed of propagation does not alter by 0.1 per cent. Tynda l, in his classic work on sound, cites the instance of the firing of a gun in the Arctic regions, when the report of the gun was heard before the command of the officer to fire. This would indicate that a pulse or shock upon the air traveled faster than a prolonged tone 2. If there should be no apparent discrepancy, does this exclude *very slight* variation, due perhaps indirectly to change of vibration number? A. The cause of the slight difference noticed is not stated.

(12808) M. S. asks: I would like to know if you could tell me whether there are any laboratories (chemical or biological) or laboratories belonging to large manufacturing companies which employ boys (16 to 18 years) for making tests on different materials or substances, setting up and cleaning up apparatus? A. There is doubtless just such a place as you describe somewhere and for some one who finds it. But we do not know where nor how to find it. There are not many such anywhere. In most places a young man is wanted who has had a good course in chemistry or in the branch of work in which he will have employment. A course of education is necessary nowadays for one to make a start in life with much prospect of a rise or of getting to the top in time. Conditions are changing, and the young man must be well trained before he sets out to work in any skilled employment.

(12809) L. A. McC.: 1. Will you tell me, through the Notes and Queries column, if I can grind convex lenses without the aid of expensive instruments, and if so, how? A. Lens making is not simple and easy work, but many amateurs have succeeded well by painstaking and persistent work. You will find the necessary instructions in Orford's "Lens Work for Amateurs," price 80 cents postpaid. The apparatus required is not expensive. 2. What is the probable average temperature of the equatorial region of Mars? If this temperature is below the freezing point of water, how do the astronomers explain the "canals," since ice cannot flow? A. It is generally supposed by astronomers that the summer of Mars is warm enough for vegetation and that the canals are filled with water, with crops growing on their banks. The polar caps disappear as summer comes on, just as they would on the earth. It is inferred that they are ice and snow melting in the spring sunshine. 3. Is the theory, which I heard some time ago, that Mars is inhabited by intelligent vegetable life, probable? A. There is little to be said against the theory that Mars is inhabited by intelligent beings. Nor do we see any harm likely to come from such a belief if one desires to hold it.

NEW BOOKS, ETC.

BAU UND BETRIEB VON PRALL-LUFTSCHIFFEN. Von Richard Basenach. II Teil. Allgemeine Darstellung des Entwurfs und Konstruktion. Munich und Berlin: Verlag von R. Oldenburg, 1912.

This second volume of Basenach's book on nonrigid airships discusses the subjects of lifting capacity and the determination of the important points of the gasbag, such as the centers of buoyancy, of displacement, and of gravity. The author has thoroughly considered the stresses which are set up in the fabric of the envelope and of the influence of internal gas pressure and of the load to be lifted. Taken together, the two volumes by Basenach may be regarded as a very clear and excellent text-book on an important phase of aeronautics.

MECHANISCHE GRUNDLAGEN DES FLUGZEUGBAUES. Von A. Baumann. Teil I und II. Munich und Berlin: Verlag von R. Oldenburg, 1912.

The two volumes by Baumann on the mechanical foundations of flying machine construction are remarkably good, partly because they give an immense amount of practical information with the aid of very simple mathematics, and partly because they include a discussion of the practical application of the more recent aerodynamic researches. The author promises us a third volume, in which the stability of flying machines will be taken up.

MODERN ORGANIZATION. An Exposition of the Unit System. By Charles De Lano Hine. New York: The Engineering Magazine Company, 1912. 12mo.; 110 pp. Price, $2.

Emerson with his efficiency staff, and Taylor with his functional management, have each developed systems of internal economy that have been applied widely and with most marked and satisfactory results. Major Hine here gives us a third mode of bringing line and staff into harmonious relationship, a mode in which each department head becomes at the same time special staff counsel and active line officer, thus extending his sense of responsibility to the efficiency of the whole organization, while retaining it for his own department. This result is brought about by the subtle influences surrounding the introduction of a new viewpoint, and minimizes the disturbances and the positive antagonisms which decided physical changes almost always produce. No cumbersome machinery is brought into use. The unit system is in successful operation on the Harriman lines. It is well worth the consideration of all organizers and managers, and its plan for the correction of over-centralization and over-specialization seems as applicable to manufacturing and industrial organization as to that of transportation.

THE DESIGN OF STEEL MILL BUILDINGS. And the Calculation of Stresses in Framed Structures. By Milo S. Ketchum, C.E. New York: McGraw-Hill Book Company, 1912. 8vo.; 562 pp.; 270 illustrations. Price, $4 net.

This third and enlarged edition of Prof. Ketchum's "Steel Mill Buildings" is noticeable for the care and the expert knowledge that characterizes all his books. In it he deals with dead, snow, wind and miscellaneous loads, with stresses in framed structures, roof trusses, portals, arches and beams; design is presented under the captions—Framework, Corrugated Steel, Roof Coverings, Side Walls and Masonry Walls, Foundations, Floors, Windows and Skylights, Ventilators, Doors, Shop Drawings and Rules, Paints and Painting, Estimate of Weight and Cost. There is a section devoted to miscellaneous structures, and appendices dealing with specifications, with problems in graphic statics, and with structural drawings, estimates and designs.

COST REPORTS FOR EXECUTIVES. By Benj. A. Franklin. New York: The Engineering Magazine Company, 1913. 8vo.; 149 pp. Price, $5.

In cost accounting, as in all pursuits involving a mass of figures and a daily routine, what is intended merely as means to an end not infrequently becomes the end itself. When the significance of the imparted facts becomes lost in the labor of their collocation and presentation, cost accounting defeats its own purpose. Mr. Franklin opens the blinded eye, and very clearly shows executives of manufacturing plants what they ought to expect of their cost system, and how to increase and to retain its vitality and usefulness.

MOTION PICTURE WORK. A General Treatise on Picture Taking, Picture Making, Photo-Plays and Theater Management and Operation. By David S. Hulfish. Chicago: American School of Correspondence, 1913. 8vo.; 297 pp.; illustrated.

The time is ripe for the appearance of such a work as this, which exhaustively presents the details of a new industry employing thousands of people and offering recreation and education to millions more. Whether the reader is interested in the manufacturing or the exhibition end of the business, he will find here full information upon any point he may be desirous of learning. The construction, installment and operation of the lantern is most fully dealt with, and gives descriptions of the various machines and methods with a wealth of illustration. The actual picture-taking is described in another large section of the volume, and specifically presents the necessary conditions for producing images of the scenes or objects, for recording this image in permanent form, and for multiplying or reproducing the image into as many finished photographs as may be desired.

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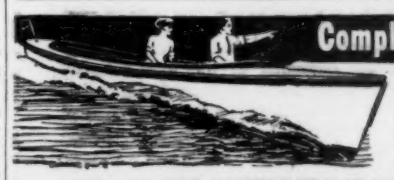

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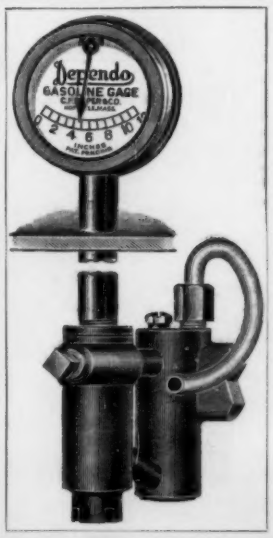

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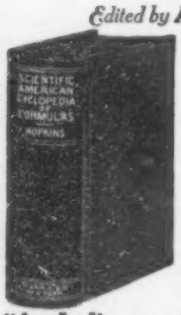

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